Forest Scale Roads Analysis
Daniel Boone National Forest

(Bath, Clay, Estill, Harlan, Jackson, Knox, Laurel, Lee, Leslie, McCreary, Menifee, Morgan, Owsley, Perry, Powell, Pulaski, Rockcastle, Rowan, Wayne, Whitley, and Wolf Counties, Kentucky)

April 16, 2003

Abstract: Roads analysis is an integrated ecological, social, and economic science based approach to transportation planning that addresses existing and future road management options. This roads analysis reviews the existing condition of the road system on the Daniel Boone National Forest. This analysis pertains to all federal, state, county, and local roads in maintenance. Resource issues, budget concerns, and other local management problems are addressed in this analysis to identify a variety of possible opportunities to improve the road system on the Forest.

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Daniel Boone National Forest

Key analysis results and findings

Since this is a broad forest-scale analysis, specific roads or units are not analyzed. The road system as a whole was reviewed. Site-specific improvements will be identified at a more appropriate scale. In general, the transportation system currently meets the strategic intent of the guidance in the 1985 Forest Land and Resource Management Plan as amended (1985 Plan). However, as with most road systems there is room for improvement. The main issues are budget related, including resolving problems with roads not in the inventory (unclassified roads) and making improvements to roads under national forest jurisdiction. Improving a road's condition addresses resource concerns such as reducing sediment delivery into waterways. Specific results and findings are:

- On average, the Southern Region of the USDA Forest Service allocated $566,000 annually to the Daniel Boone National Forest for road maintenance and construction/reconstruction since 1998. Our estimate of the most efficient budget level is $2,200,000. Current budgets of the Daniel Boone National Forest cannot meet maintenance requirements of the existing road system under the present maintenance level and management objective classification (USDA Forest Service 1995).
- Roads that cause unacceptable risk to ecosystem sustainability on the Daniel Boone National Forest are generally older roads with gravel or soil surface material, and unclassified roads and motorized routes less than 50 inches in width.
- The Daniel Boone National Forest is currently following the strategic intent of the *1985 Plan*. Management decisions at the project, watershed, and forest scale meet guidance in the *1985 Plan*.
- An extensive transportation network serves the Daniel Boone National Forest. The existing road system generally meets current access needs.
- Determining that a road is unneeded and closing the road can be controversial.
- Unclassified routes continue to be created and need to be addressed as soon as they are discovered.

Recommendations/Opportunities

These Recommendations and Opportunities are directly addressed under Goal 12 of the Proposed Revised Forest Plan (PRFP). They are also addressed under several prescription areas such as riparian corridor and rare communities.

Specific opportunities identified in this analysis (in order of importance) are:

- Minimize sediment from roads reaching streams (see AQ 1, 2, 4, 6, 9, 10, 11, 12, and 14) **(PRFP Objective 12.0.A and PRFP Objective 12.1.A).**
- Evaluate existing roads and determine if they are located correctly to meet management needs including resource protection. **[PRFP Objective 12.0.A and Objective 12.1.A(c)]**
- Some existing roads need to be improved to meet current standards **[PRFP Objective 12.0.A].**
- Past and present budgets have been inadequate to properly maintain roads to the present maintenance level and management objective classification, consider reclassifying the maintenance level and management objectives. **[PRFP Objective 12.1.A(e)]**.
- The existing inventory of the Forest system does not identify all existing roads on the Forest. This is due to many reasons, most notably – uncertain ownership/maintenance responsibilities

and unclassified roads not yet inventoried and classified for retention or obliteration. Many of these roads are directly affecting ecosystem sustainability. Unclassified motorized routes 50 inches or less create the same effects to ecosystem sustainability as unclassified roads greater than 50 inches with the same traffic and design problems (see AQ 1, 2, 4, 6, 9, 10, 11, 12, and 14) **[PRFP Objective 12.1.A(f)]**.

- Stop the introduction and spread of exotic species **(PRFP Goal 2.3)**.
- Need to coordinate the maintenance of roads maintained by other agencies to better meet the Forest's ecosystem sustainability **[PRFP Objective 12.1.A(f) and PRFP Goal 12.2]**.

Specific recommendations from this analysis (in order of importance) are:

Highest Priority Recommendations: Unit level analysis (such as watershed or ecosystem management unit) should be done forest wide on a ten-year cycle with the order of watershed analysis based upon the presence of PETS species.

- Survey all road/stream crossings to locate those that adversely impact the movement or migration of aquatic organisms and/or degrade local stream channels or water quality (see AQ 4 and 10) **(PRFP Objective 12.0.A and PRFP Objective 12.1.A)**.
- Survey system roads at stream intersections. Roads not meeting standard should either be brought to standard or their approaches closed. **[PRFP Objective 12.0.A and PRFP Objective 12.1.A(a, b, c)]**
- All stream crossings should be hardened crossings. This includes, as a minimum, bedrock stream or concrete plank crossings, both with hardened approaches to minimize sediment loading **[PRFP Objective 12.1.A(a)]**.
- Across the forest, reduce the number of road/stream crossings and the amount of roads occurring within 100 feet of streams. This is especially true in watersheds #19 and 29 (see AQ #6) **[PRFP Objective 3.0.C, Objective 12.0.A and PRFP Objective 12.1.A(b)]**.
- Reduce road densities on slopes greater than 40 percent (see AQ #2). During watershed analysis, identify roads that should be closed or rerouted **[PRFP Objective 12.0.A and PRFP Objective 12.1.A(c)]**.
- Move roads out of areas such as riparian areas, near rare communities, archeological sites etc **[PRFP Objective 12.0.A and PRFP Objective 12.1.A(d)]**.
- A second priority for order of unit level analysis should be areas susceptible to slope failures due to the amount of roads on unstable geology (see AQ #3) **(PRFP Objective 12.1.A)**.

High Priority Recommendations: Unit level analysis (such as watershed or ecosystem management unit) should be done forest wide on a ten-year cycle with the order of watershed analysis based upon the presence of PETS species.

- Reclassify and adjust the existing road system, so that expected budgets will be adequate to maintain the system. Identify unneeded roads when reclassifying the existing road system. **[PRFP Objective 12.1.A(c, e)]**.
- Make use of GIS when considering the need and placement of new roads or the closure of existing roads in relationship to rare communities and species.
- Close some roads in areas with high road densities. (See AQ #2). Specific road closures would be identified at the "Unit level" **[PRFP Objective 12.0.A and PRFP Objective 12.1.A(e)]**.

Other Recommendations: Unit level analysis (such as watershed or ecosystem management unit) should be done forest wide on a ten-year cycle with the order of watershed analysis based upon the presence of PETS species.

- Place all existing travel ways in the roads map layer and roads database, including: roads that touch NFS land; and roads that provide access to NFS land within the purchase unit boundaries within the Forest proclamation boundary.
- Identify all unclassified roads and eliminate, or classify and insure some entity is responsible for their maintenance (see AQ 1, 2, 4, 6, 9, 10, 11, 12, and 14) **[PRFP Objective 12.1.A(f)]**.
- For roads where maintenance responsibilities are uncertain, meet with other regulatory agencies (e.g. county, state) and determine who will assume road maintenance responsibilities **[PRFP Objective 12.1.A(f) and PRFP Goal 12.2]**.
- If no agency assumes responsibility, and a road crosses National Forest System lands, consider closing and road obliteration **[PRFP Objective 12.1.A(f) and PRFP Goal 12.2]**.
- Where an agency assumes responsibility, encourage bringing road to National Forest design standards for its intended use **[PRFP Goal 12.2]**.

Incorporate as part of normal maintenance where feasible: ***(PRFP Goal 2.3)***

- Eliminate undesirable exotic species along roads.
- Modify road-grading standards to include techniques that will reduce the spread of exotic invasive species such as: Do not grade shoulders and ditches infested with exotic invasive weeds towards portions of roads without these weeds. Do not push material from shoulders and ditches toward wings at stream crossings or elsewhere.
- Monitor exotic invasive pests (primarily weeds) along the road system.
- In contracts that work along roads, make use of contractual clauses that will help control the spread of weeds.
- Use current information and exotic pest plant lists to help in the selection of appropriate seed mixtures used to stabilize roads.

Introduction To Forest Roads Analysis

Description of the Process

Roads analysis comprises six steps aimed at producing needed information and maps. Line officer participation is essential to the process. Although the analysis consists of six sequential steps, the process may require feedback and iteration among steps over time as the analysis matures. The amount of time and effort spent on each step will differ, based on specific situations and available information. The process provides a set of possible road-related issues and analysis questions, the answers to which can inform the choices made about future road systems. Line officers and interdisciplinary (ID) teams can determine the relevance of each question, incorporating public participation as deemed necessary. The ID team also utilized information from Forest Service Manual (FSM) 7712.13b Roads Analysis at the Forest or Area Scale. Information required from the FSM is addressed in the key analysis results and findings section of this document found on Page v.

Step 1 — Setting up the analysis. The analysis must be designed to produce an overview of the road system. Line officers will establish appropriate ID teams and identify the proper analytic scales. The ID team will develop a process plan for conducting the analysis. The output from this step will include assignment of ID team members, a list of information needs, and a plan for the analysis.

Step 2 — Describing the situation. The ID team will describe the existing road system in relation to current Plan (1985 Plan) direction. Products from this step include a map of the existing road system, descriptions of access needs, and information about physical, biological, social, cultural, economic, and political conditions associated with the road system.

Step 3 — Identifying issues. The ID team, in conjunction with line officers and the public, will identify important road-related issues and the information needed to address these concerns. The ID team will also determine data needs associated with analyzing the road system in the context of the important issues, for both existing and future roads. The output from this step includes a summary of key road-related issues, a list of screening questions to evaluate them, a description of status of relevant available data, and what additional data will be needed to conduct the analysis.

Step 4 — Assessing benefits, problems, and risks. After identifying the important issues and associated analytical questions, the ID team will systematically examine the major uses and effects of the road system including the environmental, social, and economic effects of the existing road system, and the values and sensitivities associated with areas without roads. The output from this step is a synthesis of the benefits, problems, and risks of the current road system and the risks and benefits of building roads into areas without roads.

Step 5 — Describing opportunities and setting priorities. The ID team and line officers will identify management opportunities, establish priorities, and formulate technical recommendations that respond to the issues and effects. The output from this step includes a map and descriptive ranking of management options and technical recommendations.

Step 6 — Reporting. The ID team will produce a report and maps that portray management opportunities and supporting information important for making decisions about the future characteristics of the road system. This information sets the context for developing proposed actions to improve the road system and for future amendments and revisions of forest plans.

Forest Service Manual Requirements

The following information is required for a Forest scale roads analysis and is identified in FSM 7712.13b. Roads analysis at the Forest scale is critically important; as it provides a context for road management in the broader framework of managing all forest resources. The ID team addressed all of the requirements in FSM 7712.13b. Many of the items in section one were specifically addressed during steps 4 and 5 of this roads analysis process. A couple of the requirements in Section 2 were also addressed in the responses to the 71 questions. However, all the requirements of FSM 7712.13b were completed as a result of this analysis. During step 4, the ID team utilized other Forest staff specialists to respond to the 71 questions. For specific responses to the 71 questions, please refer to the Step 4 section. During step 5 of this analysis, six additional questions were addressed.

1. Consider the following at this scale:

1(a) Environmental. This was addressed during steps 4 and 5. Most of the questions in step 4 respond to environmental effects. Refer to step 4 and question 1 in step 5.

1(b) Social Issues. This was addressed during step 4. Refer to questions SI (1) - SI (10) and CR (1).

1(c) An evaluation of the transportation rights-of-way acquisition needs. This was addressed during step 4. Refer to questions GT (1).

1(d) The interrelationship of state, county, tribal, and other Federal agency transportation facility effects. This was addressed during step 4. Refer to questions GT (1) – GT (4) and AQ (1) – AQ (14).

1(e) Transportation investments. This was addressed in the "Description of Existing Situation" and during steps 4 and 5. Refer to questions EC (1) – EC (3) and question 2 in step 5.

1(f) Current and likely funding levels. This was addressed in the "Description of Existing Situation" and during steps 4 and 5. Refer to questions EC (1) – EC (3) and question 2 in step 5.

2. Prepare a report with accompanying map(s) that documents the information and analysis methods used to identify access and environmental priorities, issues, and guidelines for future road management and the key findings. At a minimum, the report will:

2(a) Inventory and map all classified roads[1], and display how these roads are intended to be managed. Classified roads were inventoried and mapped. The infrastructure (INFRA) database documents the intended use and maintenance level. INFRA is an integrated inventory of and financial data for its constructed features, including buildings, dams, bridges, water systems, roads, trails, developed recreation, range improvements, administrative sites, heritage sites, general forest areas, and others. The engineering staff maintains the maps and INFRA database.

2(b) Provide guidelines for addressing road management issues and priorities related to construction, reconstruction, maintenance, and decommissioning. The guidance in the *1985 Plan* and the Proposed Revised Forest Plan for reconstruction, maintenance, and decommissioning properly display accurate needs and priorities.

2(c) Identify significant social and environmental issues, concerns, and opportunities to be addressed in project level decisions. Questions were identified that were outside of the scope of this analysis and would be more appropriate for a project level analysis.

2(d) Document coordination efforts with other government agencies and jurisdictions. The result of this analysis is incorporated into the Proposed Revised Forest Plan. The Draft Plan and EIS are provided to other government agencies and jurisdictions for comment.

[1] Classified roads are roads wholly or partially within or adjacent to National Forest System lands that are determined to be needed for long-term motor vehicle access, including State roads, National Forest System roads, and other roads authorized by the Forest Service.

Area included in the Roads Analysis

The Roads Analysis ID team identified the area to include for the Forest Scale Roads Analysis. The team considered using boundaries set by watersheds, but decided that due to time, people, money, and information constraints, it was not feasible for the Forest-wide analysis. More detailed analyses can be completed later at the watershed or project level.

The team set the geographic boundary for the analysis as:

- Federally owned lands administered by the Daniel Boone National Forest.
- Roads considered in the analysis are roads in the existing road inventory administered by the Daniel Boone National Forest.

The Daniel Boone National Forest contains 697,902 acres. The proclamation boundary of the Forest is much larger, containing 2 million acres. The remaining acreage is private, state, or other Federal property.

Step 1-Setting Up the Analysis

Scope of the analysis

Roads analysis is an integrated ecological, social, and economic approach to transportation planning, addressing both existing and future roads. The analysis neither makes decisions nor allocates lands for specific purposes. It provides information for decision making by examining important issues. It also helps implement the Forest Plan by identifying management opportunities that can lead to site-specific projects. This process can also help identify needed changes in forest plans to be addressed in amendments or revisions.

The analysis will examine the existing Forest roads system in the context of the present and projected social and economic situation in the area. The analysis will consider the present local, state and federal roads within the area. It will examine the role of national forest roads in meeting the needs of the local area as well as the present and future administrative needs in the management of the National Forest.

This *Forest Scale Roads Analysis* has been completed to help identify opportunities for potential management actions that may be considered in subsequent environmental analysis for proposed projects. This analysis will also be utilized during the revision of the Daniel Boone National Forest Land and Resource Management Plan to help identify long-term road management opportunities.

The analysis will cover the 21 counties that have government land under the administration of the Daniel Boone National Forest. Most major roads, such as interstate highways and parkways, that serves the Daniel Boone National Forest lie within the 21 counties.

Staff specialists will examine the effects of the road system on the environment and the flow of traffic within the study area. They will provide estimates of needs, costs and possible changes for the entire Daniel Boone National Forest road system as a whole. Existing inventory data will be used in this analysis. Individual road information will be combined to provide an overview of the roads system, its needs and potential.

Roads Analysis report objectives

- Inventory and map all classified roads, and display the road management objectives of National Forest System roads.
- Provide recommendations for addressing road management issues and priorities related to construction, reconstruction, maintenance, and decommissioning.
- Identify significant social and environmental issues, concerns, and opportunities.
- Document coordination efforts with other government agencies and jurisdictions.
- Use relevant scientific literature in the analysis, and disclose assumptions on which the analysis is based.

List of Interdisciplinary Team members

The Interdisciplinary Team for this analysis consists of:

- Kevin W Lawrence - Planning Staff Officer
- Richard Wilcox - Plan Revision Team Leader
- James Boyd - Civil Engineer
- Mason Miller – Recreation/Engineering Forest Staff officer
- David Taylor - Botanist
- George Chalfant – Soil Scientist
- Jim Bennett – T & E Biologist
- John Omer – Aquatics Specialist
- Jon Walker – Hydrologist
- Corey Miller – Geologist
- Victoria Bishop - Fisheries Biologist
- Dick Braun – Forest Biologist
- Paul Finke - Silviculturist
- Beth Buchanan – Ecologist
- Cecil Ison – Archeologist
- Fred Marriott – Dispersed Recreation Specialist
- Mike Rock – Land, Water, Minerals Program Manager

Information used to complete the analysis

- The existing roads layer, topographic layer, streams layer, soils layer, Cultural Resource layer and Threatened and Endangered Species layer in the Geographic Information Map system.
- The existing roads inventory in the INFRA database.
- The existing watershed risk analysis.
- The most recent county road maps.
- Kentucky's Best Management Practice and existing Clean Water regulations.
- Socio-economic Overview of the Daniel Boone National Forest.

Step 2 – Describing the Situation

Description of the lands within the analysis area

The proclaimed boundaries of the Daniel Boone form a narrow strip of land 140 miles long on the western edge of the Cumberland Plateau; the Redbird Purchase Unit lies in the Eastern portion of the Plateau. As is characteristic of many National Forests in the east, the Daniel Boone is not circumscribed as one large unit of ownership and its Districts are separated geographically from each other. Because of the physical separation of administrative units, there are differences in management practices due to variations in geography, topography, and forest composition.

The Daniel Boone National Forest is located in the eastern Kentucky mountains. Within the administrative unit of two million acres, the United States own 697,902 acres that are managed by the U. S. Forest Service. This is about one third of the area.

Although industrial ownership is limited, there are major holdings in Clay and Leslie counties of the Redbird Purchase Unit. These holdings including subsurface, are held mainly for coal and other private mineral resources.

Three state parks, Natural Bridge, Buckhorn, and Cumberland Falls, are located on 4,550 acres that lie within the proclamation boundary. There are also four Corps of Engineers reservoirs that lie within the Forest: Cave Run Lake, Buckhorn Lake, Lake Cumberland and Laurel River Lake. These lakes contain 63,850 acres of water at normal pool level and 85,690 acres at maximum pool level. The Big South Fork National River and Recreation Area lies on the southern border of the Daniel Boone National Forest.

The topography of the Daniel Boone is generally rugged, characterized by steep slopes, narrow valleys, and precipitous cliffs. The Forest extends along the western edge of the eastern Kentucky coalfield and is included within the Appalachian Plateau physiographic section of the United States.

The Cumberland Plateau makes up the western edge of the Forest; it is a bench like upland with relatively low relief. The Pottsville Escarpment, a resistant sandstone belt of cliffs and steep valleys, makes up its western most margin, as well as the western border of the Daniel Boone. Most of the Forest is included in the Cumberland Plateau and upland with terrain ranging from hilly to mountainous; containing steep sided, winding valleys and ridges. The area is a combination of flat-topped ridges and rolling hills that are dissected by thousands of miles of small branches and streams, many of which flow only after intense rains. Local relief ranges from about 400 feet to the north to about 2,000 feet to the south.

The Cumberland Mountain Section is represented along the southern border of the Redbird Purchase Unit. While resembling the Cumberland Plateau, overall relief of this area is greater.

The Daniel Boone National Forest crosses portions of drainages of the Licking, Kentucky, and Cumberland Rivers. Past and present uses of and abuses on private lands, some of which have been subsequently acquired by the Forest, contribute to the poor water quality of some streams in conjunction with present activities on the Forest (e.g., brine disposal from oil and gas operations, roads, active and abandoned mines, etc.).

All streams on the Forest are subject to severe local flooding because of steep gradients and shallow soils. The same conditions are also responsible for the intermittent nature of most of the smaller streams.

Existing water quality on the Forest is generally excellent, except in those 4th and 5th order streams impacted by brine disposal from oil and gas drilling and by acid mine discharges from abandoned surface and deep coal mines, mostly originating from private land or from abandoned mining activities now under National Forest administration.

Riparian areas are a distinctive resource comprised of aquatic and riparian ecosystems, 100-year floodplains and wetlands. These areas are important for ground water recharge, moderation of flood peaks and water quality improvement and maintenance, vegetative communities; fish and wildlife; and visual, cultural and recreation qualities.

Description of the existing road management situation

The existing road system contains roads that were acquired as part of land acquisition. Acquired when public passageways were abandoned by local governments and were needed for public access in and through the National Forest and roads constructed by the Daniel Boone National Forest to provide access to the National Forest. Many of the original roads were improvements made to horse trails through communities and to homes, railroads beds that were converted to roads and then extended to homes or communities and public passageways that were never formally recognized by local governments but were in use as the National Forest acquired land in and around them.

Nearly all arterial and collector roads are already in place. The vast majority of the local roads under Forest Service (FS) jurisdiction are dead-end roads, terminating on NFS land and gated or otherwise closed to public motorized vehicles. The FS may develop some additional all-weather, aggregate surfaced roads and parking lots. These roads and parking lots would be for improving public access to inaccessible tracts of forest and for providing minimum facilities for parking, primitive camping and resource use. We expect that all-weather local roads constructed or reconstructed on National Forest land will average 0.5 miles in length or less. Although there have been no specific corridors selected or specific plans developed at present, the FS may cooperate with local counties or the State of Kentucky to relocate or reconstruct existing collector or arterial roads as opportunities arise.

The Forest Development Road system consists of 1334.5 miles of roads. Related to this system there are low water crossings, 16 culverts with a greater than 35 square feet openings and 4 bridges. Only those roads needed for access and mobility for National Forest Management are considered part of the system. The Forest Road Atlas functionally classifies all roads in the system as Forest Arterial, Forest Collector or Forest Local. Forest Arterial roads serve as major access routes to and through large land areas. All types of traffic normally found on public roads may be expected. Forest Collector roads are generally connecting roads serving smaller areas of land, and are used by all types of traffic normally found on public roads. Forest Local roads are generally short length roads, which normally dead-end at a terminal facility and usually serve a specific user or activity. About 446 miles of the 1334.5 miles of road are classified as arterial and collector roads. 888 miles are classified as local roads. The Forest Service maintains 600 miles (about 45 percent) annually.

The following figures depict summaries of the transportation system managed by the Daniel Boone National Forest at the present time. These mileages are for National Forest System roads, i.e. roads solely under Forest Service jurisdiction. They do not include roads within the National Forest boundary, but under local, county, state, and other federal, or private jurisdiction.

These mileages are from the Daniel Boone's INFRA database. Totals for each summary vary slightly due to rounding.

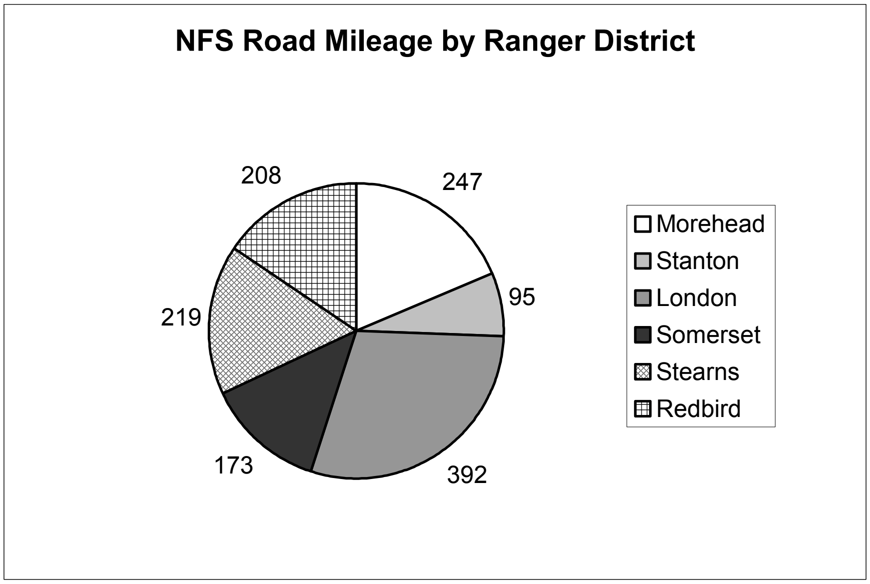

Figure 1: NF System road mileage by ranger district.

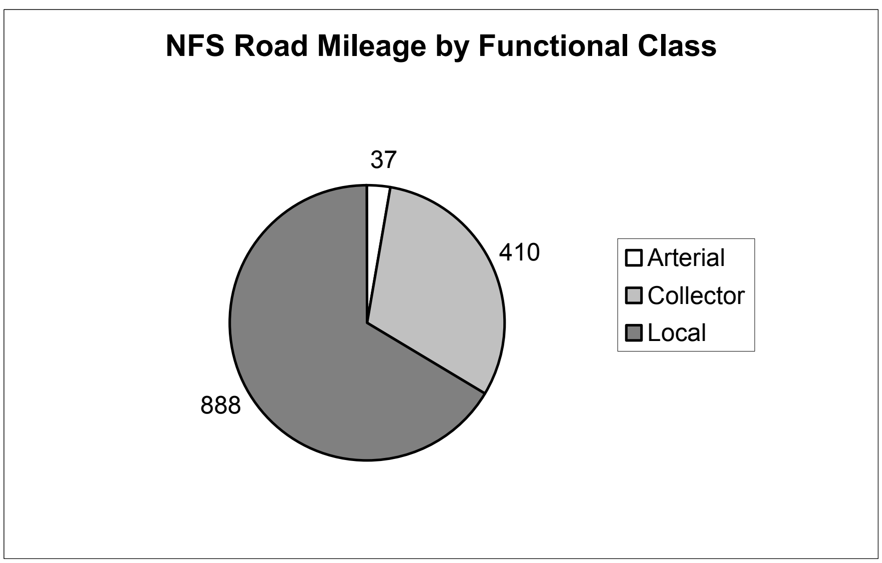

Figure 2: NF System road mileage by functional class.

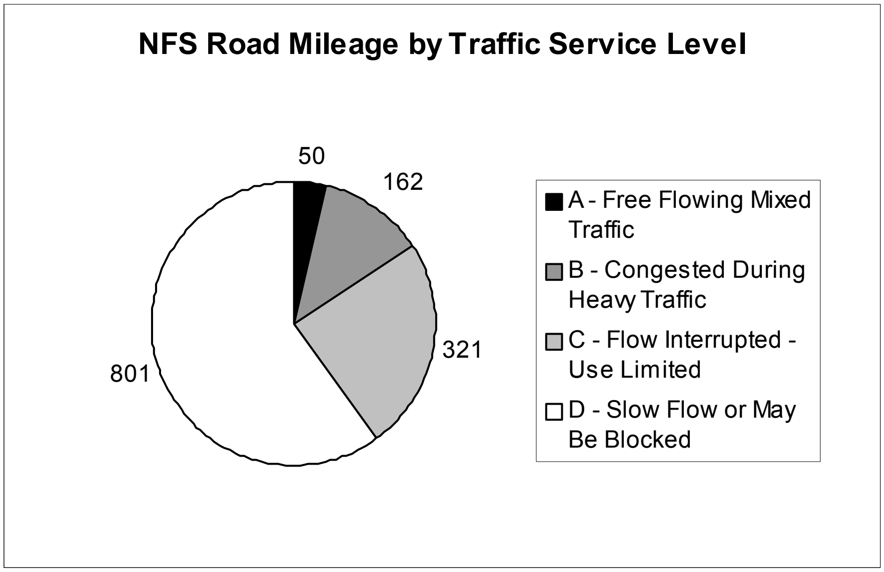

Figure 3: NF System road mileage by traffic service level.

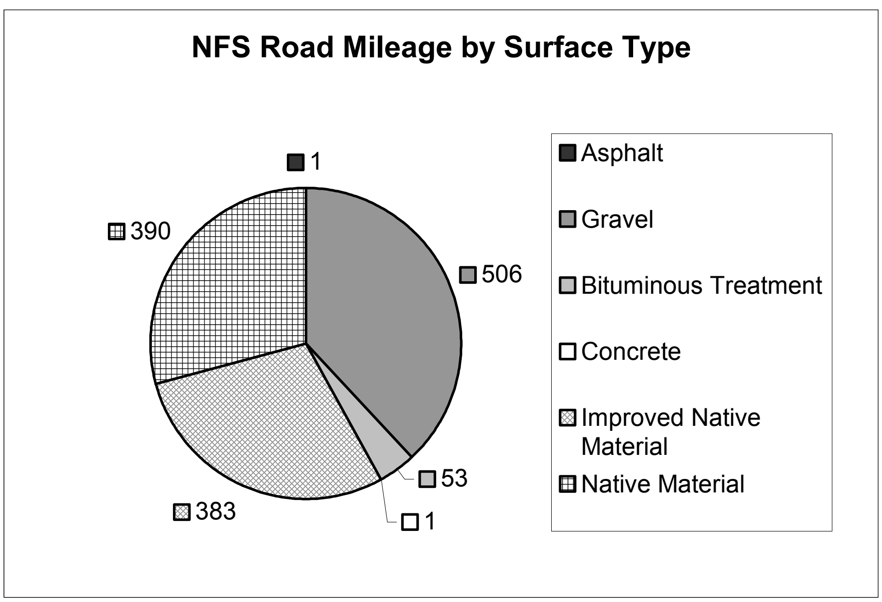

Figure 4: NF System road mileage by surface type.

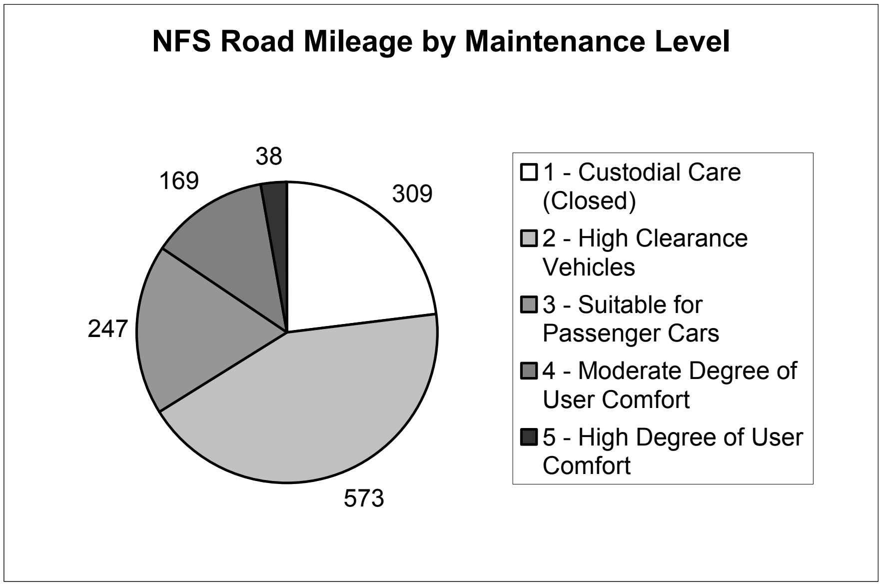

Figure 5: NF System road mileage by maintenance level.

Figure 6 is a summary of road jurisdictions from a combination of the INFRA data on NFS roads, and the public roads GIS coverage:

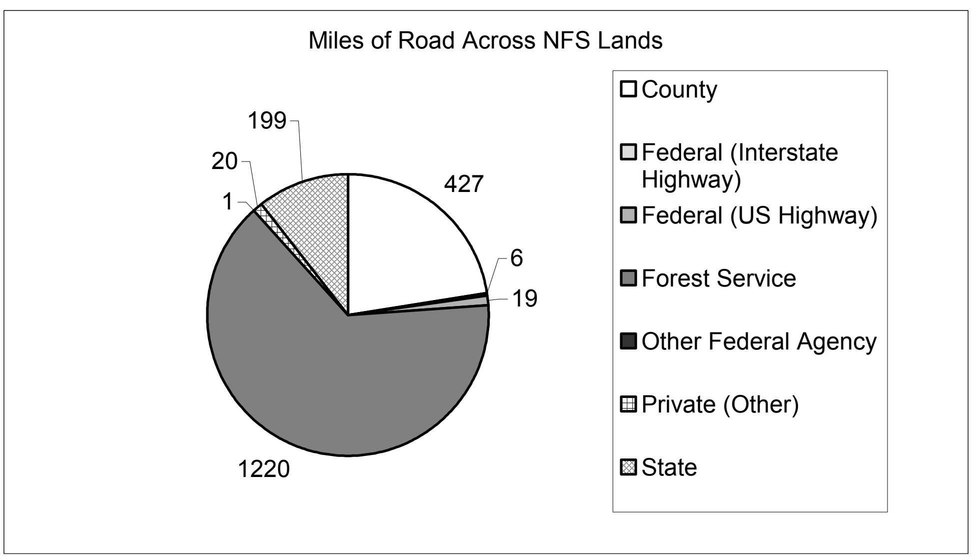

Figure 6: Roads across national forest lands by jurisdiction.

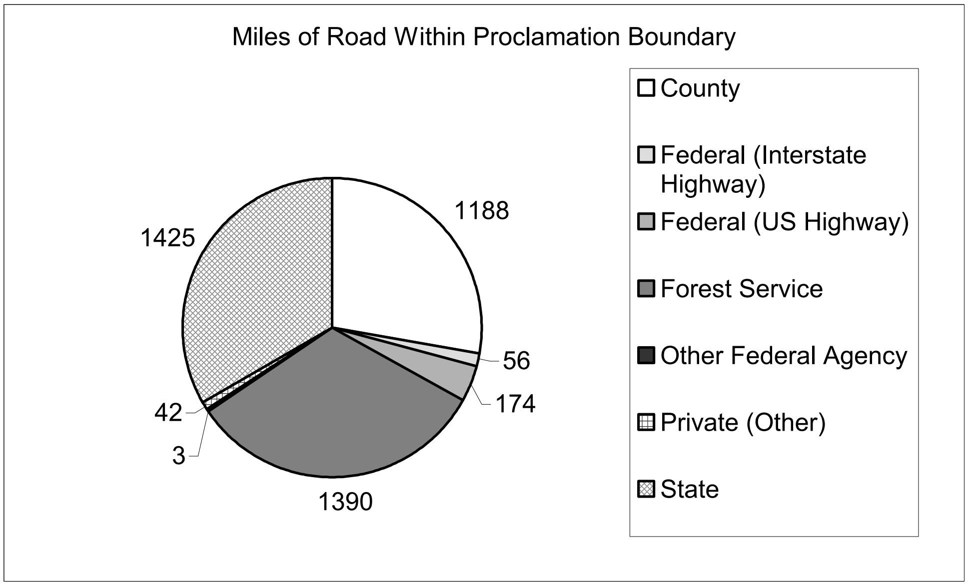

Figure 7: Roads within proclamation boundary by jurisdiction.

The miles of road by classification and maintenance jurisdiction are shown in Table 1:

Table 1: 1985 Road Classification and Maintenance Jurisdiction.

			Miles By Maintenance Jurisdiction		
Road Class	**Total Miles**	**%**	**FS**	**County**	**Other**
Arterial	120.1	5.1	43.6	76.5	0
Collector	1,088.4	46.4	322.0	757.5	8.9
Local	1,135.4	43.5	607.4	464.5	63.5
Total	2,343.9	100.0	973.0	1,298.5	72.4

Table 2: 2002 Road Classification and Maintenance Jurisdiction.

			Miles By Maintenance Jurisdiction		
Road Class	**Total Miles**	**%**	**FS**	**County**	**Other**
Arterial	98	4.0	37	61	
Collector	1092	44.2	409	683	
Local	1283	51.9	888	395	
Total	2473	100.1	1334	1139	

While local roads serve a variety of uses, they usually originated to meet a specific resource need. The arterial and collector roads normally serve a combination of resources. The high percentage of collector roads results from dependence upon numerous existing county roads to provide access to scattered federal lands.

Most of the road construction/reconstruction in the recent past is in association with the harvest of timber. For the past few years the mileage of roads constructed has decreased. Once roads have been constructed many remain open for recreation access. Presently there is a local road density of 1.09 miles of road per square mile. The density was calculated by dividing 1,135.4 miles of local roads by 1,045.9 square miles of federally owned land.

Maintenance activities vary by the management of the road. Those roads, which are closed, are assigned Level 1 maintenance. This level of maintenance consists of inspection and those activities necessary to protect soil and water resources. As the maintenance level increases, the intensity of maintenance activities also increases.

Of the total value of $163.86 million, the Forest Service maintains $57 million (Table 3). To properly meet the road system maintenance needs, the annual road maintenance appropriation should be $1,140,000. This amount is two percent of the actual value of the Forest Service jurisdiction roads.

Table 3: 1985 Mileage and Value by Road Maintenance Level

Maintenance Level	Mileage	Value (Dollars per mile)	Value (Million Dollars)
Not Inventoried	Est. (300)	4,000	(1.20)
1 – custodial, closed	914.7	10,000	9.15
2 – high clearance	694.3	60,000	41.66
3 – low clearance	443.2	125,000	55.40
4 – medium comfort	203.7	175,000	35.65
5 – high comfort	88.0	250,000	22.00
Totals	2343.9		163.86

1985 Road Maintenance Mileage and Values

Table 4: Roads Maintenance Level 8/11/01

Maint. Level	Forest Development Roads (miles)						
	Forest	Morehead	Stanton	London	Somerset	Stearns	Redbird
5 - High (Paved)	38.1	17.6	6.0	12.5	0.1	1.4	0.5
4 - Moderate	171.3	36.6	21.6	57.2	18.0	36.8	1.1
3 - Min. Passenger	242.4	43.4	10.5	63.7	33.2	56.3	35.3
2 - High Clearance	570.9	105.1	33.0	159.1	75.2	67.3	131.2
1 - Closed Road	319.1	43.2	23.9	105.7	45.1	59.3	41.9
Total	1341.8	245.9	95.0	398.2	171.6	221.1	210.0

Table 5: Roads Service Level 6/20/96

Service Level	Forest Development Roads						
	Forest	Morehead	Stanton	London	Somerset	Stearns	Redbird
A - Free Flowing (paved)	50.32	34.55	3.14	37.69	0.10	1.50	0
B - Heavy/All vehicles	161.95	16.51	22.46	38.97	17.06	37.48	9.79
C - Some Difficulty	313.11	70.41	18.70	89.11	42.85	61.36	37.04
D - High Center/ Single Track	785.35	122.93	52.50	175.43	112.15	119.59	148.03
Total	1310.73	244.40	96.80	341.20	172.16	219.93	194.86

Table 6: Roads by Closure 6/20/96

Closure	Forest Development Roads (miles)						
	Forest	Morehead	Stanton	London	Somerset	Stearns	Redbird
Open	427.29	45.47	26.74	72.21	48.8	87.52	47.65
Gated	529.99	162.84	33.26	196.1	57.45	70.17	106.98
Closed	131.58	36.09	15.70	51.79	12.56	7.00	25.33
Total	1088.86	244.40	75.70	320.10	118.81	164.69	179.96

Recent road budgets

The primary transportation system is in place. During the last five years (1997–2001) there were 20.7 miles of road reconstructed and 4.4 miles constructed.

Figure 8 shows recent road budgets compared with the *1985 Plan* estimates in calendar year 2000 dollars. Road budgets in the figure include both road maintenance and road construction funds. As shown, road budgets are below *1985 Plan* expectations.

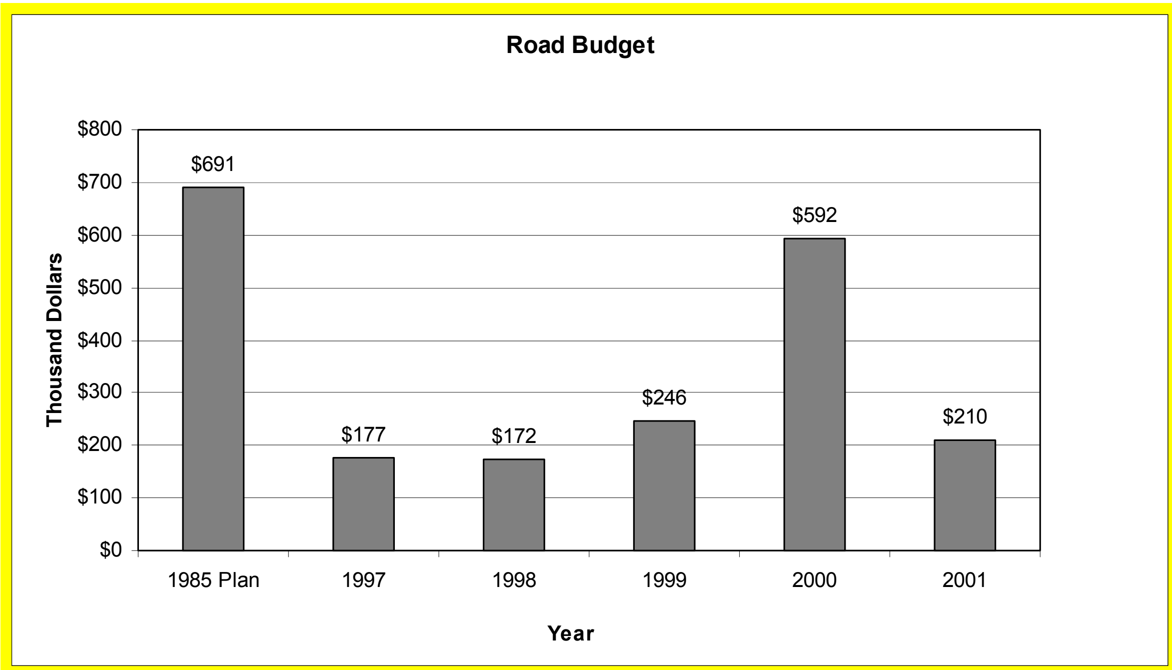

Figure 8: Daniel Boone National Forest Roads Budget

Table 7: Forest Road Budget Need (1998)

	Maintenance Level					
Budget Items	**ML1**	**ML2**	**ML3**	**ML4**	**ML5**	**Total**
Maintenance Mileage	308	572	247	169	38	1334
Heavy Brushing / Mowing		$57,116	$52,008	$33,293	$6,270	$148,687
Re-establish Template		443,150	$62,800	$45,000	$00	$550,950
Surface Replacement		$264,000	$633,600	$479,640	$157,035	$1534,275
Drainage		$51,928	$26,611	$17,035	$5,616	$101,190
Signing		$13,934	$4,950	$3,168		$22,052
Total Maintenance	$5,470	$430,128	$779,969	$578,136	$168,921	$1,962,624

Step 3 - Identifying Issues

Key Issues

During Step 3 “Identifying Issues”, the interdisciplinary team identified 14 issues relevant to the Roads Analysis process. The roads-related issues identified in the scoping of the Forest Plan revision, and input at public workshops (August 1998, November and December 2001) and correspondence were also incorporated to form the key issues.

1. **The Forest Service does not have legal authority or jurisdiction to manage all roads within the Forest boundary, including unclassified roads.** (Addressed in Step 5 – question 1, and the “Executive Summary.”)
2. **Closure of National Forest System roads restricts access by the Forest Service and the public to areas of the National Forest, even though the closure may help protect the environment.** (This analysis has identified some potential reasons for closure but not where specific closures should occur. The watershed and site-specific analysis should consider how a road closure would affect public access.)
3. **Closure of National Forest System roads restricts cemetery access.** (This issue cannot be addressed at the Forest level and should be considered on a site-specific level. When access problems are brought to the attention of the Forest Service.)
4. **Forest Service does not always provide the most desirable access to private land for the landowner.** (The Forest is obligated to provide an opportunity for access to private property. The determination of appropriate access is a site-specific decision beyond the scope of this Forest analysis.)
5. **There are not enough properly located and well-maintained roads to provide needed access to the Forest’s minerals and forest products.** (The Forest analysis identifies opportunities for improving the existing system. The determination of appropriate access is a site-specific decision beyond the scope of this Forest analysis.)
6. **There are existing roads that are not properly located or properly maintained.** (Addressed in Step 5 - Questions 1 & 5. There is an opportunity to locate and correct this situation on a watershed or site-specific level.)
7. **Roads provide access, which may lead to degradation of heritage resources**. (As addressed in Step 4 Social Issues, the effect on heritage resources may be negative in some locations and provide for better protection in other locations. For this reason the impact to heritage resources is best addressed at the watershed or site-specific level.)
8. **The Forest Service does not have the budget to properly maintain all of the existing road system or address all the unclassified roads.** (Addressed in Step 5 - Questions 1 & 2. It is an opportunity for improving the existing present road system.)
9. **Roads may have an adverse effect on water quality, aquatic habitat and fauna.** (Addressed in Step 5 - question 1 & 5. There is an opportunity to locate and correct this situation on a watershed or site-specific level.)
10. **Roads may have an adverse effect on sensitive habitat: e.g. caves, karst, clifflines and wetlands.** (Addressed in Step 5 - Questions 1 & 5. There is an opportunity to locate and correct this situation on a watershed or site-specific level.)
11. **Roads may contribute to habitat or forest fragmentation.** (Addressed in Revised Plan EIS)
12. **Roads may contribute to exotic species dispersion.** (Addressed in Step 5 - Questions 1 & 5. There is an opportunity to locate and correct this situation on a watershed or site-specific level.)

13. **Roads may have an adverse effect on water quantity and timing.** (Addressed in Step 5 - Questions 1 & 5. There is an opportunity in some cases to modify the affect at the watershed or site-specific level.)
14. **Roads may contribute to human-caused fires**. (As addressed in Step 4 Administrative Use and Protection, the effect of roads on human-caused fires may be negative in some locations and provide for better protection in other locations. For this reason the impact to human-caused fires is best addressed at the watershed or site-specific level.)

Other issues were discussed, such as unroaded areas, roadless areas, and road/trail classification (USDA Forest Service 2000d). However, it was determined that these were not issues related to the roads analysis process. These issues would be addressed during *Forest Plan* revision.

Step 4-Assessing benefits, problems, and risks

This section assesses the effects of roads on the Daniel Boone National Forest. To complete this assessment, the ID team used 71 specific questions from Appendix 1 in "Roads Analysis: Informing Decisions about Managing the National Forest Transportation System" (USDA Forest Service 1999). Overall Forest Service road management policy and objectives found in Forest Service Manual 7700 – Transportation systems (USDA Forest Service 2001b) were also considered. Detailed information regarding how these questions were answered can be found in the project file.

Ecosystem Functions and Processes (EF)

EF (1): What ecological attributes, particularly those unique to the region, would be affected by roading of currently unroaded areas?

The Forest has one inventoried roadless area. The 2,800 acre Wolfpen area is adjacent to the Clifty Wilderness. Almost all of the existing public roads originated in some form over 60 to 100 years ago, before Federal acquisition of the land. Many roads originated as wagon roads and old railroad beds. Nearly all arterial and collector roads are already in place on the Forest. Many of these collector and arterial roads are under state or county jurisdiction, and are open to public motorized traffic at all times. Most future Forest Service road development and operation activities would be associated with local forest roads. Forest Service road activities are not planned in the inventoried roadless area.

EF (2): To what degree do the presence, type and location of roads increase the introduction and spread of exotic plant and animal species, insects, diseases, and parasites?

A widely held thought about biological invasion is that it is promoted by disturbance. Building roads into a forest's interior and subsequently maintaining them (including ditch clearing, road grading, and vegetation clearing) includes disturbances that creates and maintains new edge habitat. A suite of exotic species can invade these roadside habitats. Roads may be the first point of entry for exotic species into a new landscape, and the road can serve as a corridor along which the plants move farther into the landscape. Some exotic plants may then be able to move away from the roadside into adjacent patches of suitable habitat. Invasion by exotic plants may have significant biological and ecological effects if the species are able to disrupt the structure or function of an ecosystem. Invasion may also be of concern to land managers if the exotic species disrupt management goals and present costly eradication problems.

In general, the existence of roads appears to have had little effect on forest tree diseases, but there are some examples where building or using roads caused significant local effects such as damage to lower portions of roadside trees. Nearly always, the negative effects can be improved through simple modifications in how roads are built and used. The one benefit of roads related to tree diseases is to provide access for silvicultural activities that protect a variety of resources, such as to inoculate decay fungi into trees to create wildlife habitat. One negative effect includes the movement of people on the roads, which increases the opportunity to introduce pest species. Road building may also set the stage for an insect attack that further stresses the trees and sets the stage for a disease outbreak that kills them. Roads provide a means by which exotic species can spread more rapidly into non-infested areas. Through the movement of people, their belongings, forest products and other material, exotic species may be moved great distances in a short period of time. This can lead to the establishment of populations well removed from the generally infested areas.

Forest Specific: Use and maintenance of roads and trails on the Forest are the largest contributors to the continuance and spread of Nepal Browntop/Japanese Grass (*Microstegium vimineum*), False Skullcap (*Mosla dianthera*), and Crown Vetch (*Coronilla varia*). The first three species fair best in disturbed, somewhat open, moist ground. The last species is usually found in open, drier sites. Woods, roads, and trails are ideal habitat for the species. Use of these corridors carries mud-encrusted seed further into forested areas. Shaded roadsides and ditches also provide habitat for the species. Ditch and shoulder maintenance on Forest roads are the single largest factor contributing to the maintenance and spread of Nepal browntop, and to a lesser extent, false skullcap, along roads and into other habitats. Seeds in the soil and mud are carried along the road from one place to another as the ditch is cleared and reshaped. At stream crossings, the accumulated soil is pushed to the side to create a water diversion wing. Water passing along this seed-laden soil picks up seeds, which are then carried to the stream corridor. Suitable habit for Nepal browntop is also present in the stream corridor. Once a population is established, flowing water carries the seed downstream to additional sites. The DBNF has forest types very susceptible to exotic pests that have been found or have become established in other parts of the country; gypsy moth, hemlock woolly adelgid, beech bark disease, and Asian long-horned beetle, to name a few.

Discussion: Although few habitats are immune to at least some invasion by exotic or other aggressive plants, predicting which species will become pests is usually difficult. Assessing the scale of a biological invasion problem is complicated by the typical lag between when an exotic or aggressive native is introduced and when it begins to expand its distribution and population size in a new area. Cowbirds, for example, can be introduced into forest environments by roads and subsequently affect populations of Neotropical migratory birds through nest parasitism. The spread of pathogens where roads act as vector is described in the Forest Diseases section. Few environmentally benign approaches to exotic plant control or eradication have been tested

Roads of any sort in the very limited geographic range of the primary host provide a way to move soil, along with the fungus, from infected to uninfected areas. Spread of the fungus can be checked by careful planning to reduce entry to uninfected areas, road closures, partial road closures during wet weather, attention to road surfaces and drainage of possibly contaminated water to streams, wash stations to remove soil from vehicles before entry to uninfected areas, and sanitation strips to remove host plants from near roadsides. Building and maintaining roads may exacerbate root diseases. Wounded trees and conifer stumps created and not removed during road building provide infection courts for annosus root disease; the disease may then spread through root contacts to kill a patch of trees. Trees damaged or stressed by road building become susceptible to a variety of tree diseases through direct wounding of stems and roots, covering roots with side castings, or by compacting soil over roots. Armillaria root disease is benign in deciduous stands where only injured trees are attacked but more serious in conifer stands where pockets of disease are initiated. Oak decline is associated with poor sites, older stands, and road building or other disturbance.

Roads indirectly contribute to disease spread by giving people access to remote forests and ways to transport material long distances. New pockets of both oak wilt and beech bark disease may have resulted from moving firewood from the forest to a home site.

Forest-Specific considerations: Because control and eradication of exotic species is difficult and usually expensive, and may also create unwanted side effects, prevention is the best measure. The Region has produced a series of timber sale contract clauses specifically allowing the cleaning of equipment before operating in an area free of invasive weeds. Use of this clause for timber sales and other projects will help the Forest contain infestations of many exotic weed plants and keep some areas free of weeds.

Reliability, confidence, and limitations: Field studies on exotic plants tend to focus on a particular geographic region, and observed patterns of road-supported invasion may not apply to other regions. In general, however, observations suggest that biological invasion is often a negative effect of extending roads into forest interiors. Such effects should be considered in the design and execution of road network extensions.

Observations in different settings suggest that the exotic species that successfully invade, and the scale of invasion problems, differ regionally. Some exotic species can become significant pests, and others remain fairly benign.

Information to access the degree of risk relies on case studies; the risks may be slight or significant. A less than ideal science base exists for identifying, which exotic species pose the greatest threat and what preventive or remedial measures are appropriate. Retrospective studies may help identify directions. One study showed that abandoned roads had fewer exotics (both in number of species and frequency of individuals) than did roads that were in use.

Conclusions: Consequences of biological invasions link to habitat quality issues (including changes in plant community structure and function), other edge effects, and effects on sensitive or threatened species.

In general, roads that are not in use have fewer weeds on or along them than those that are in use. However, it appears that even infrequent use including foot travel, provides enough disturbance to maintain and probably spread some species such as Nepal browntop and false skullcap.

Building and maintaining a database of known infestations of noxious weeds, to which future observations can be compared, would improve prevention and eradication efficiency.

EF (3): To what degree does the presence, type and location of roads contribute to the control of insects, diseases, and parasites?

Roads allow equipment used in control of insects, diseases and parasites to reach infested locations that might otherwise not be reached. Roads in some circumstances may also provide a perimeter from which eradication or control can be effectively launched. Roads may hinder control as they can serve as access points for new infestations from sources such as gypsy moths carried in on vehicles into a clean area.

Monitoring measures for insects, diseases and parasites is similar to that for noxious weeds. Building and maintaining a database of specified insects, diseases, and parasites would improve prevention and eradication efficiency. Surveys would require considerable time and money to complete.

EF (4): How does the road system affect ecological disturbance regimes in the area?

Roads within cliffline zones, particularly those above clifflines, have a great potential of disturbing the existing hydrologic regimes of these sensitive habitats. Reducing the water flow into the cliffline system would have the potential to enact changes that are different from background levels. Habitat parameters would change benefiting some species and hurting others.

Roads contribute to increased levels of stream sedimentation, especially during storm events. The existence of roads in and/or near riparian areas provides direct conduits for silt-laden runoff into forest streams thereby increasing the level of impact upon aquatic organisms. While storm events naturally increase sediment loads in forest streams, the presence of roads clearly exacerbates the situation.

EF (5): What are the adverse effects of noise caused by developing, using, and maintaining roads?

Generally, Forest System Roads are relatively lightly used when compared to County, State or Federal highways. Thus, noise associated with all aspects of these roads is limited in duration and volume. While noise can limit the utilization of habitats adjacent to heavily traveled roads, this result would not be expected to occur in most instances on Forest System Roads. Some unoccupied, suitable habitat may occur as a result of developing, using and maintaining roads, but the size of this area should be relatively small and its impact on populations to be of little consequence.

Aquatic, Riparian Zone, and Water Quality (AQ)

AQ (1): How and where does the road system modify the surface and subsurface hydrology of the area?

Roads can affect the routing of water through a watershed by intercepting, concentrating, and diverting flows from their natural flow paths. These changes in routing can result in increase in peak flows by both a volumetric increase in quick flow and changes in the timing of storm runoff to streams (Wemple et al. 1996).

Surface and subsurface water movements are strongly influenced by local topography and geology, which are best addressed at the watershed and project scale.

AQ (2): How and where does the road system generate surface erosion?

Surface erosion occurs on most wildland roads because their surface, cut-slopes, fill-slopes, and associated drainage structures are usually composed of erodible material and are exposed to rainfall and concentrated surface runoff. Surface erosion differs greatly depending on many factors, the most influential of which are usually the erodibility of the exposed surface; the slope of the exposed surface; and the area of the exposed surface that generates and concentrates the runoff. Surface erosion and associated sedimentation are highly sensitive to road maintenance practices. Small changes in road drainage configuration can result in large changes in erosion and the routing of eroded sediments. (USDA Forest Service 2000a and 2000b)

Most of the roads within and under control of the DBNF are composed of erodible material. Others like federal, state, and county roads are mostly hard surface roads. These latter roads would contribute erosion more through their cut-slopes, fill-slopes and associated drainage structures than through their surface runoff.

For each watershed, road density (Figure 10) and the miles of road on slopes greater than 40 percent slope (Figure 11) were used to evaluate surface erosion from the road system. It was initially thought that stream density would also help to understand this question but as Figure 14 shows, there is very little difference between any of the watersheds on the Forest.

Figure 10 shows that there are two areas of higher road densities. There is a higher potential for road related erosion in these watersheds. Since there is less than 10 percent FS managed lands in the northern group of watersheds (11, 12, 13, 16, 17, 18) most of the erosion is most likely coming from non-NFS roads. The southern groups of watersheds (25,30, 37, 38, 40, 41, 42) have a much higher percentage of National Forest lands, but most of the roads are on flatter slopes (Figure 11). Figure 11 also shows that even though the road densities are relatively low on the Redbird District, many of the roads are on steep side slopes. This could impact surface erosion rates.

AQ (3) How and where does the road system affect mass wasting?

Many Forest roads, especially those on steeper slopes, are subject to failure through mass wasting processes. The mechanisms of road-related mass wasting failures include removing slope support in road cuts, increasing the weight on fill-slopes, groundwater saturation of the road prism, intercepting subsurface flows, hill-slope drainage rerouting, and initiating debris flows at failed stream crossings. Some mass wasting road failures extend long distances downhill from the failure site. If the failure tract extends to a stream channel, the initial failure and subsequent chronic surface erosion of the slide will deliver sediment directly to the channel. These types of failures are typical where unstable road or landing fill is placed on steep slopes. Road construction on unstable slopes can increase the frequency of mass wasting failures. Debris flows and debris torrents often severely affect road/stream-crossing fills and transport fills and channel materials to higher order channels. The factors that may influence the potential for road-related mass wasting failures are hillside slope gradient, slope position, soil type, bedrock geology, geologic structure, type of road construction, road drainage, and groundwater characteristics. Some of these factors can be used in a GIS to rate the relative susceptibility of road segments to mass wasting failures. If a stream channel layer and a road system layer are present, which road segments are likely to deliver materials to the streams can be estimated. An approximation of risk can be obtained by combining the probability of road-related mass wasting failures with the potential effects to the resource of interest. The risk analysis can then be used in determining which roads receive treatment. Many roads appear relatively stable under normal climactic and geologic conditions but may fail during high intensity precipitation events or in major earthquakes.

There are several watersheds (10, 13, 29, 31) that are susceptible to slope failures due to the amount of roads on unstable geology (Figure 13) and steep slopes (Figure 11). Within these watersheds, slope failures have been observed. This is particularly true in watersheds 29 and 31. These watersheds are general areas of higher risk and identifying specific roads segments that are susceptible to failure should be done at the watershed scale.

AQ (4) How and where do road/stream crossings influence local stream channels and water quality?

Road/stream crossings with culverts can cause large inputs of sediment to streams when culvert hydraulic capacity is exceeded, or the culvert inlet is plugged and stream-flow overtops the road fill. The result is often erosion of the crossing fill, diversion of stream-flow onto the road surface or inboard ditch, or both. An inventory of all the road/stream crossings (and cross-drains, if needed) in a watershed allows assessing the distribution and severity of risks to beneficial uses from this important potential source area; screening of crossings to determine the most crucial and cost-effective ones to upgrade; and allows estimating the cost of road upgrading or decommissioning, because these costs are very sensitive to the configuration of road/stream crossings. A complete inventory of all crossings in a watershed for these purposes need not gather detailed and highly accurate data, as might be required for a contract, but can be accomplished quickly and inexpensively if methods are adjusted to the desired analytical objectives.

For the Forest scale watershed analysis, the only information that was practical to collect was the number of road/stream crossings per watershed (Figure 9). More information will need to be gathered at each potential site at the watershed scale. Water quality and aquatic vertebrate and invertebrate samples should be taken above and below the road/stream crossing. The biological samples could also be used in the evaluation of AQ (10). The Forest scale information in Figure 9 shows several watersheds that have a higher number of road/stream crossings. Forest Service managed lands in many of these watersheds is relatively low.

AQ (5) How and where does the road system create potential for pollutants, such as chemical spills, oil, de-icing salts, or herbicides, to enter the surface water?

Roads may create potential pollutants in several ways. Chemicals such as surfacing oils, de-icing salts, herbicides, and fertilizers may be applied to roads for maintenance, safety, or other improvements. Roads may also become contaminated by material from vehicles, including accumulation of small spills, such as crankcase oil, brake pad lining, and hydraulic fluid or from accidental spills of hazardous or harmful materials being transported over roads. Applied or spilled materials may have access to water bodies, depending on road drainage systems and runoff patterns. The severity of damage depends on what organisms might be exposed, their susceptibility to the material, and the degree, duration, and timing of their exposure.

The greatest threat on the Forest is from major roads, where the majority of traffic and transport of hazardous and harmful material occurs. These major roads also contribute to the majority of the de-icing salts. Figure 15 shows the concentration of major roads by watershed. At this level of detail, watershed number 24 (Upper Rockcastle) appears to have the greatest risk, with a high concentration of major roads and relatively high concentrations of aquatic PETS and total number of aquatic species. To more accurately define areas at greatest risk, this information should also be evaluated at the watershed level.

Another area of concern would be oil and gas wells and well drilling sites. Roads in these areas would have a higher concentration of traffic transporting waste and products from these sites.

AQ (6) How and where is the road system "hydrologically connected" to the stream system? How do the connections affect water quality and quantity (such as, the delivery of sediments and chemicals, thermal increases, elevated peak flow)?

To assess the potential for roads to affect water quality and aquatic habitats, a simple parameter – the extent of roads hydrologically connected to the stream network – can be used to indicate the potential for several important adverse effects:

- Hydrologic changes associated with increase drainage density and extension of the stream network [see AQ (1)];
- Delivery of road-derived sediments to streams [see AQ (2), (3), & (4)]; and
- The potential for road-associated spills and chemicals applied to roads to enter streams [see AQ (5)].

This parameter can help to distinguish between roads that have these effects or the potential for them (that is, those that are connected to streams), and roads that do not have these effects or potential (unconnected roads).

Roads (miles/acre) found within 100 feet of a stream are depicted in Figure 12 and Stream Crossings (miles/acre) by Watershed are depicted in Figure 9 for the Daniel Boone National Forest. These two maps indicate that watersheds numbered #11; 18, and 31 are those that have the higher density of road and stream crossings per mile/acre. However, National Forest ownership is very low within these watersheds. The next density level of roads within 100 feet of the stream correlated with crossings and ownership indicates that watersheds #19 and 29 to have potential for adverse impacts. These two watersheds have a relatively high percentage of National Forest ownership, roads (miles/acre) within 100 feet of stream and stream crossings (miles/acre). The maps further indicate that the rest of the Forest has varying degrees less of ownership, roads within 100 feet of the stream and stream crossings. Because of this varying degree of the three main components in this analysis, the analysis should be done at a watershed scale to be effective and not at the Forest level.

AQ (7) What downstream beneficial uses of water exist in the area? What changes in uses and demand are expected over time? How are they affected or put at risk by road-delivered pollutants?

Water and water bodies have a great many potential uses and benefits, and the distribution, value, and sensitivity of the potential uses often differs greatly from area to area. Identifying what values can be affected and making an assessment of the degree to which they are affected by roads is crucial. Some potential beneficial uses include but are not limited to:

- Fish habitat
- Aquatic organisms other than fish
- Reservoirs
- Domestic water supplies
- Municipal water supplies
- Recreational uses
- Water supplies for industry
- Visual values
- Ecosystem interactions value
- Use by wildlife that is associated with riparian and aquatic habitats, both those that are capable of surviving in only one environment (obligate), and those capable of adaptive response to varying environments (facultative).

Demand for the many products, amenities and recreational opportunities provided by the Daniel Boone National Forest is high and is expected to increase in the future. The aquatic fauna is especially vulnerable to changes in land and water use. An increase in these activities comes with an increase in the transportation system. With an increase in the transportation system comes an increase in populations with their increasing demands on water sources for domestic, municipal, and recreational use. An increase in roads within the Forest will add sedimentation, erosion problems, and possibly the reduction of the natural water flow regime. One important aspect of the Forest's water, especially in the southern half, is that with the increased demand for water the possibility for new reservoirs within the major watersheds increases and will be detriment to the aquatic fauna. Recreational uses of all the watersheds are high and so diverse that recreational use mapping has not been completed at this time.

AQ (8) How and where does the road system affect wetlands?

Roads can affect wetlands by direct encroachment through changes in hydrology. Roads can modify both surface and subsurface drainage in wetlands, causing changes in wetland moisture regimes. Where roads cross or are near wetlands, the effect on wetland form, process, and function is evaluated by examining the degree to which the local hydrology is modified, in terms of flow quantity, timing, routing, and water quality. Sedimentation rates are also directly affected by changes in hydrology. These in turn can further change wetland hydrology. Roads may also provide a conduit for de-icing salts and chemicals from spills to reach wetlands. Where roads cross the streams, weed seeds have a high likelihood of reaching wetlands where establishment can be detrimental to the system.

On the DBNF, this would be best addressed at the watershed level. Information needed to best address this question would be GIS layers of roads, streams, and locations of all types of wetlands.

AQ (9) How does the road system alter physical channel dynamics, including isolation of floodplains; constraints on channel migration; and the movement of large wood, fine organic matter, and sediment? (Actual effects can only be identified at the watershed or project level.)

Stream channels are dynamic. They migrate within historic floodplains, eroding the bed and banks in one place while aggrading the bed and building new banks in other places. Streams also transport and deposit large pieces of woody debris and fine organic matter, providing physical structure and diverse aquatic habitat to the channel. When roads encroach directly on stream channels, these processes can be modified. Wood and sediment can be trapped behind stream crossings, reducing downstream transport and increasing the risk of crossing failure. Road alignment and road fills can isolate floodplains, constrict the channel, constrain channel migration, and simplify riparian and aquatic habitat. In some places, road encroachment can divert stream-flows to the opposite bank, thereby destabilizing the hill-slope and resulting in increased landslides. Changes in flow rates and their maxima and minima created by runoff and altered flow paths can change sedimentation rates, altering floodplain and wetland dynamics, especially along smaller streams.

GIS coverage overlaying roads (all types), streams, floodplains, and riparian areas. All crossing types would be identified (culvert, bridge, low water ford, etc.). Actual effects can only be identified at the watershed or project level.

AQ (10) How and where does the road system restrict the migration and movement of aquatic organisms? What aquatic species are affected and to what extent? (Actual effects can only be identified at the watershed or project level.)

Road/stream crossings can sometimes block the migration of fishes and other organisms in streams, which can have serious consequences on fish life histories and populations. Sometimes maintaining barriers at road crossings is desirable where such barriers prevent invasions by unwanted aquatic species. Most culvert migration blockages prevent or restrict upstream migration, though sometimes downstream migration through a culvert can pose hazards to the fish from poor outlet conditions (for example, high perch with no outlet pool). Blockages at the crossing may be partial or total; they can affect adult spawners, migrating juvenile fish, or both. A variety of factors affect the nature of culvert migration barriers. Determining the extent of the problems and a feasible and effective range of solutions requires analysis with an interdisciplinary approach, drawing from fisheries biology, hydraulics, engineering, geomorphology, and hydrology.

GIS coverage overlaying roads (all types) and streams. All crossing types would be identified (culvert, bridge, low water ford, etc.). More detailed information would be needed about each crossing at different water levels and the potential species that may be affected.

AQ (11) How does the road system affect shading, litter fall, and riparian plant communities?

When roads are constructed adjacent to streams, riparian vegetation is often removed to accommodate the road right-of-way, improve visibility, and reduce the hazard of trees falling on the roadway. This action can reduce shading of the stream, causing increased stream temperatures, reduced potential for recruiting large woody debris in the stream, reduced leaf fall and riparian invertebrates, and loss of habitat for aquatic and riparian species. Flow rate and sedimentation rate changes can drastically alter floodplain and wetland plant communities along streams as the result of changes in the effective water table level along the stream.

For watersheds located within the Forest, Figure 12 shows the miles of roads per acre that are located within 100 feet of a stream. This includes stream crossings. This information should be viewed at the watershed level to accurately identify individual sites of greatest risk. Additional useful information at the watershed level would be: GIS coverage overlaying roads (all types), riparian areas, streams, cover types, critical habitats, and locations of all rare, unique, and/or PETS species.

AQ (12) How and where does the road system contribute to fishing, poaching, or direct habitat loss for at-risk aquatic species?

Recreational use of aquatic resources, if improperly managed, can contribute significantly to decline of rare or unique native vertebrate populations or damage to important habitats. The presence of the road system facilitates access to streams, lakes, and wetlands where at-risk species may live.

For watersheds located within the Forest, Figure 12 shows the miles of roads per acre that are located within 100 feet of a stream, which includes stream crossings. This information should be viewed at the watershed level to accurately identify individual sites of greatest risk. Additional useful information at the watershed level would be: GIS coverage overlaying roads (all types), streams, boat ramps, access points, and all areas where rare, unique, and/or PETS species and/or communities are located.

AQ (13) How and where does the road system facilitate the introduction of non-native aquatic species?

Introduction of non-native sport fishes, whether authorized or unauthorized, have the potential to affect the distribution and abundance of native fishes, amphibians, and other aquatic organisms. Exotic aquatic plants may also be introduced to lakes and streams from boats and boat trailers. Unauthorized releases of aquarium fishes, bait fishes, exotic amphibians and reptiles, and non-native plants to streams and lakes are strongly influenced by road access.

On the Forest the introduction of non-native fish is high due to the nearness of the streams and lakes to roads and due to the high fishing nature of the human population in the area. Anywhere in the Forest where a road comes close to a stream there is likely to be someone fishing at any time. Along with fishing come the use of natural bait and the likelihood of bait bucket introductions. Also, various non-native sport fish are actively stocked in approximately 15 streams within the Forest's proclamation boundaries. Specifically, trout (several species in various locations) are stocked presently in Rock Creek (of Big South Fork), Bark Camp Creek, Cane Creek, Chimney Top Creek, Craney Creek, Big Double Creek, Indian Creek, War Fork, Middle Fork, Red River, Swift Camp Creek, E. Fork Indian Creek, N. Fork Triplett Creek, Slabcamp Creek, Minor Creek, and Triplett Creek. Lakes are very likely introduction sites for non-native species, intentionally or non-intentionally. Both reservoirs (Laurel River Lake and Cave Run Lake) found on the Forest are stocked by the state and this stocking is the main source of sport fishing. Lake Cumberland is partially publicly owned and is stocked by the state as well. One imminent non-native introduction that would cause extreme harm to local fauna is the zebra mussel. (This has already been introduced to one reservoir.) Boats, trailers, and other fishing transport this organism and recreational equipment being moved from infested waters to non-infested waters. Adults can live out of the water for several days and larvae are inadvertently transported in live wells. With the movement of watercraft from the north (where the mussel is established) infestation of the Forest's waters is just a matter of time. The reservoirs have many boat ramps for access (Laurel Lake – 8, Cave Run – 14, and Lake Cumberland has over 20+) and approximately two marinas each. Each of these sites is a possible introductory site along with the shoreline from which people fish.

AQ (14) To what extent does the road system overlap with areas of exceptionally high aquatic diversity or productivity, or areas containing rare or unique aquatic species or species of interest?

The spatial coincidence of roads with areas of exceptionally high aquatic diversity or productivity, or areas containing rare or unique aquatic species is a first step in determining if roads are affecting them. Roads in these areas may be a high priority for detailed examination and analysis needed to determine the extent of actual effects.

The Daniel Boone National Forest has a high degree of diversity in aquatic species and rates third in the south for the diversity of aquatic fauna. Figure 10 depicts the road density by watershed across the Forest via miles/acre. Four watersheds have a high aquatic diversity along with a high incidence of road density. These four watersheds are #29, 37, 38, and 40. There are two watersheds that contain high numbers of aquatic PETS species and that coincide with high road density. These two watersheds are #29 and #38. The rest of the Forest varies with the road density and aquatic diversity. Most have moderate road densities with various degrees of diversity and PETS species.

Terrestrial Wildlife (TW)

TW (1) What are the direct effects of the road system on terrestrial species habitat?

Roads have myriad effects on species habitats within the forest; some positive, some negative.

1. Roads provide flight corridors for many species of bats.
2. Road ruts provide drinking opportunities for bats and egg laying habitat for salamanders. Road ruts also provide habitat for a number of uncommon bryophytes, which are found exclusively or nearly so on shaded mud in various degrees of wetness.
3. Roads provide breaks in the forest canopy (edge) that is utilized by less shade tolerant species.
4. Roads can act to fragment habitat for species with small home ranges such as snails.
5. Roads cause direct mortality to individuals of many species unable to avoid motor vehicles.
6. Roads allow a level of human disturbance that some wildlife species will avoid thereby causing otherwise suitable habitat to be unoccupied.

TW (2) How does the road system facilitate human activities that affect habitat?

1. Roads allow Forest Service personnel access to sites for habitat management projects.
2. Roads allow access by arsonists.
3. Roads allow access to cave sites that would otherwise be considered remote. This access potentially increases disturbance of bat hibernation and/or maternity sites, perhaps rendering these sites unsuitable for habitation.
4. Roads can serve to concentrate human use in areas unsuitable for that level of unregulated disturbance.
5. Species, which exist in the disturbance habitat in road corridors, are directly affected by changes to habitat with each passage of person, animal or vehicle.

Background

Roads may facilitate human activities that result in habitat disturbances. Disturbances may include removing structures (snags and logs), losing habitat to fires resulting from human ignitions, and destroying habitat by trampling (**Table 8**).

Scale

Effects are seen at the site, and road scales should be evaluated at the watershed scale.

Information needs

Determine if otherwise suitable habitat would be made less valuable by changes in road-related disturbance.

Determine effects of habitat disturbances, including burning, removing structures (snags, logs), or directly destroying habitat (such as camping in riparian zones).

Table 8: Road-associated factors affecting habitat loss

Road-associated factor	Effect of factor in relation to roads	Example Citations
Snag reduction	Reduction in density of snags and/or areas where snags are present due to removal near roads, as facilitated by road access	Hann and others (1997) Quigley and others (1996)
Down log reduction	Reduction in density of logs and/or areas where logs are present due to removal near roads, as facilitated by road access	Hann and others (1997) Quigley and others (1996)
Direct loss	Habitat loss from trampling in campgrounds and other direct disturbances	
Loss to fire	Habitat lost to fire resulting from increased incidence of human-caused ignitions	Hann and others (1997)

TW (3): How does the road system affect legal and illegal human activities (including trapping, hunting, poaching, harassment, road kill, or illegal kill levels)? What are the effects on wildlife species?

Background

Roads allow both legal and illegal impacts on species through hunting, trapping, poaching, collecting, harassing, road kill, disruption of dispersal, displacement, and other negative interactions with people (**Table 9**). The magnitude of these effects depends on road density, intensity of road use, road location, types of habitats traversed by roads, and the status of populations in the surrounding area.

Scale

Effects are seen at the site and road scales but they should be evaluated at the watershed scale.

Information needs

- Map of road system showing traffic volume
- General map of forest cover types
- List of species affected by road-related activities in the planning area
- Estimate density of each species in each cover type
- Probability of road kill for species in the area

Analytical tools and information sources

- Determine how roads affect rates of trapping, hunting, poaching, or illegal kill and what effect such changes have on populations in the area.
- Identify effects of road-related harassment.
- Based on acres of habitat and density of populations by cover type, estimate population size of each species in the planning area affected by road-related activities.
- Estimate potential yearly loss of individuals from existing records or judgments.
- Evaluate yearly losses against estimated population size.
- Evaluate whether losses pose enough risk to a population's persistence to suggest changes in the road system are warranted.

Table 9: Road-associated factors affecting species populations

Road-associated factor	Effect of factor in relation to roads	Example Citations
Over-trapping	Non-sustainable or non-desirable legal harvest by trapping, facilitated by road access	Bailey and others (1986) Hodgman and others (1994)
Poaching	Increased illegal take (shooting or trapping) of animals, facilitated by road access	Cole and others (1998) McLellan and Shackleton (1988)
Collecting	Collection of live animals for human uses (such as collecting amphibians and reptiles for pets), facilitated by the physical characteristics of roads or by road access	Nussbaum and others (1983)
Harassing or disturbing at specific use sites	Direct interference of life functions at specific use sites due to human or motorized activities, as facilitated by road access (such as increased disturbance of nest sites, breeding, or communal roost sites)	Forman (1995); White (1974)
Collisions	Death or injury resulting from a motorized vehicle running over or hitting an animal on a road	Blumton (1989) Boarman and Sazaki (1996) Vestjens (1973)
Movement barrier	Preclusion of dispersal, migration, or other movements as posed by a road itself or by human activities on or near a road or road network	Bennett (1991) Mader (1984)
Displacement or Avoidance	Spatial shifts in populations or individual animals away from a road or road network in relation to human activities on or near a road or road network	Forman and Hersperger (1996) Mech and others (1988)
Chronic, negative	Increased mortality of animals from increased contact with people, facilitated by road access	Mace and others (1996) Thiel (1985)

(adapted from Wisdom and others, in press)

TW (4): How does the road system directly affect unique communities or special features in the area?

Roads provide direct access to otherwise remote areas. Roads also provide access for trucks and trailers that carry OHVs, horses, and trail bikes, thus giving these means of transportation direct access to many additional acres of unique communities or special features. This access sets the stage for several potential adverse affects including increased human trampling, the introduction of exotic weedy species and changes in cliffline hydrology.

Another unique community that has been impacted by roads is the natural ridge-top pond. Historically, many more of these unique features are believed to have been present on the landscape prior to road building activities. In many instances, roads have been built through the pond site. At other locations, roads are built around the pond site, but drastically change the limited watershed hydrology of these small areas.

Roads may affect high-quality, often rare or unique communities, in several ways. An immediate threat in many cases is increased potential for invasion of exotic plants and animals that may threaten or eliminate populations of native species in the area. This in turn affects biodiversity at several scales. Roads can affect the hydrology of rare communities, making either wetter or drier. Roads may directly cause the death of populations of rare species where the road crosses migration paths, affecting community structure and stability. Roads also provide immediate access for predators, including humans, which can disrupt community stability.

Forest Specific: Several bogs with rare communities have been infested with exotic invasive plants, a direct result of road corridor passage. In at least one, the rare plants are seriously threatened. In two other cases, runoff, laden with weed seeds from roads above a cliff, has resulted in infestations of exotic invasive plants in rockhouse habitat below. At least one glade system has been seriously degraded as a result of a noxious weed planted on the road bank for erosion control. The weed moved into the glades and took over.

Roads may directly affect special features such as caves, bogs, cliffs, and glades. Roads may change contours on the ground, which in turn can alter water, air and debris flow, affecting the conditions maintaining these features, or possibly directly altering them. Roads may pass through directly or immediately adjacent to the areas seriously harming or destroying the sites.

Forest Specific: Several roads have been built through cliffs, a process requiring blasting. This has completely altered and or destroyed sections of cliffs and glades. Roads passing along or above bogs or other wetlands have altered water flow resulting in destruction or degradation of the sites.

Measures: Using GIS determine how many identified rare or sensitive communities are affected by roads, using existing cliff buffer and predicted locations as threshold for cliffs. For other communities, distance thresholds will need to be established, and locations will need to be mapped.

Economics (EC)

EC (1): How does the road system affect the agency's direct costs and revenues? What, if any, changes in the road system will increase net revenue to the agency by reducing cost, increasing revenue, or both?

Financial efficiency analysis asks whether a project or program generates more revenue than it consumes. Road budgets are below *1985 Plan* expectations ($690,620). An estimate of the most efficient budget levels is $1,970,000. There are no revenues (commercial permits or cooperative maintenance agreements) associated with road management on the Daniel Boone National Forest.

Road maintenance costs include the following factors: maintenance/service level, topography, soils, miles, amount of use, and vehicle impact. Increases in miles, total use, and vehicle impact increase costs. The type of road (i.e. maintenance/service level) affects initial investment as well as timing and amount of repair costs. A higher service level road will have higher initial and repair costs, but will need less frequent maintenance than a lower service-level road having the same use. Roadbeds on steep, sensitive, erosive soils are more costly to maintain.

For forest management (e.g. forest inventory work), the more accessible an area is, the less the cost/accomplishment.

As accessibility increases to areas where timber harvesting (which produces revenue) is being preformed, revenue increases.

This question can best be answered at the Watershed level.

EC2: How does the road system affect the priced and non-priced consequences included in economic efficiency analysis used to assess net benefits to society?

The following are general priced and non-priced consequences of roads:

Biological: Some plants and animals are specifically destroyed during road construction, maintenance and use. Runoff from roads and changes in hydrology typically negatively affects aquatic flora and fauna. However, entire populations are seldom significantly affected. Rare communities are protected during road activities on the National Forest. Greater access improves hunting success, changing game population dynamics.

Air Quality/ Fire: Emissions from vehicles using roads negatively affects air quality. The road system positively affects the Forest Service's ability to control smoke from wild land fire. Greater access increases chance of arson, but also increases our ability to control fires.

Water Quality: Is reduced to some degree, since siltation is increased.

Commodity Production: Is increased.

Recreation: Generally is increased, with the exception of wilderness-like recreation, which is negatively affected.

Heritage Resources: Greater access increases the temptation for vandalism/ theft, at the same time increasing enforcement's opportunity to catch such law-breakers.

Economic efficiency will be addressed at a watershed scale.

EC (3): How does the road system affect the distribution of benefits and costs among affected people?

When doing economic distribution analysis, we identify the distribution of benefits and costs in society. Distribution analysis can be either financial or economic. Financial distribution analysis includes only direct cash flows. Examples include job and income gains or losses by different sectors of the economy. Economic distribution analysis adds non-market and external values and costs. Examples of this type of distribution consequences include who incurs the negative effects of air or water pollution and who benefits from enhanced scenic beauty or solitude. This analysis can best be done at the watershed scale.

Timber Management (TM)

Forest Plan Revision Issues

- The issue concerning the production of timber products by the Forest has several facets, including definition of the appropriate goals for the program; determination of where, at what level, and how removal of timber products should occur; and how much impact on the environment is acceptable for this activity.

- The Forest provides a variety of resources and opportunities to the American public. The access that is provided to the Forest by the road and trail systems is critical to making these opportunities and products available. On the other hand, too many roads or trails, or having the wrong kinds in the wrong places can also limit the Forest's ability to provide public benefits in a sustainable manner.

Discussion

Roads are essential to the management of the Forest. Roads provide access to the Forest for managing the various resources to produce commercial products. Forest and mineral products occur as either renewable or non-renewable resources (Table 10). The availability of Forest and mineral products may depend on the presence of a road system. Roads are needed during the planning, designing and implementation of activities in order to make such products available. Efficient management of resources is dependent on the presence of roads. The further from a road an activity is, it is likely to cost more to accomplish, and the more likely it will not be implemented.

Some activities, such as timber harvesting require that a road be present from the point where the product is loaded onto a truck for transport to a processing plant. Timber activities normally occur within approximately a quarter mile of a road. Other activities, such as firewood gathering and post and pole removal normally occur within approximately 100 feet of a road. Other activities, such as collecting ginseng and moss normally occur up to a mile or more from a road. For the purpose of this analysis, an activity will be placed in one of four categories that reflect the distance from a road that an activity is likely to occur (Table 11).

Table 10: Some commercial products on the DBNF

Products	Renewable	Non-renewable	Maximum distance an activity would occur from a road (feet) *
Firewood	X		MEDIUM
Timber harvesting	X		LONG
Coal		X	CLOSE
Gas		X	LONG
Oil		X	LONG
Pine Bough	X		MEDIUM
Christmas Tree	X		LONG
Ginseng	X		FAR
Moss	X		FAR
Fence post & pole	X		MEDIUM
Mushroom	X		LONG
Rock		X	CLOSE

* These distances are estimates of typical operations and are not intended to apply in all situations.

Table 11: Distance categories for activities, DBNF

Category	Maximum Distance (feet)
Close	20
Medium	500
Long (1/4-mile)	1320
Far	10,000+

TM (1): How does road spacing and location affect logging system feasibility?

Logging systems normally used on the DBNF are ground-based where slopes are gentle. However, on steeper slopes, cable systems are normally used. For the purposes of this analysis, a 40% slope will be considered as the breaking point between ground-based and cable logging systems. A reasonable distance from a road for cutting and removing trees is about ¼-mile for ground-based equipment and 1,000 feet for cable logging. Isolated tracts of NFS lands can pose a challenge because they may not have road access and the cost of that access is likely to exceed the timber value.

Terrain is a limiting factor. Streams and cliffs provide obstacles for road access. Where broad ridge tops occur, roads usually occur on the ridge tops. Where the ridges are narrow, roads usually occur near a stream or on the side of a hill. Based on the location of a road, on the top or near the bottom, determines whether logs are skidded up hill or downhill to a landing.

When areas are more than ¼-mile from a road, landscape assessment level analysis teams should evaluate the need and placement for road construction. New roads may become part of the transportation system or be temporary. Site-specific project analysis is the appropriate time to evaluate and document the effects of road construction on the environment.

A Forest-wide analysis of road needs was done using the corporate geographic information system (GIS) database. Approximately 94% of NFS lands are available for timber harvesting. Approximately 73% of the available lands occur on slopes less than 40% (Table 12). For the more gentle terrain (less than 40% slope), road access appears to be adequate on approximately 72% of the area, which indicates that approximately 28% of the area is in need of some road construction.

For the steeper terrain (greater than 40% slope), road access appears to be adequate on approximately 65% of the area, which indicates that road access is needed on approximately 35% of the area.

Table 12: Lands available for timber harvest, DBNF

Management Area	Total NFS land (acre)	Area initially unavailable* for timber harvesting (acre)	Area occurring as isolated tracts (acre)	Area initially available for timber harvesting (acre)	Slope less than 40% (acre)	Slope greater than 40% (acre)
Licking	119,000	11,000	0	108,000	101,000	7,000
Cumberland	337,000	17,000	Nominal	320,000	265,000	55,000
Upper Kentucky	91,000	13,000	Nominal	78,000	69,000	9,000
Lower Kentucky	145,000	2,000	1,000	142,000	40,000	102,000
Total	**692,000**	**43,000**	**1,000**	**648,000**	**475,000**	**173,000**

* Preliminary estimate of Unsuitable Lands (Stage I areas), year 2002.

Table 13: Logging accessibility by management area, DBNF

Management Area	Slope less than 40%		Slope greater than 40%	
	Area within 1,320 feet of a road (acres)*	Area further than 1,320 feet of a road (acres)*	Area within 1,320 feet of a road (acres)*	Area further than 1,320 feet of a road (acres)*
Licking	62,000	39,000	4,000	3,000
Cumberland	207,000	58,000	41,000	14,000
Upper Kentucky	46,000	23,000	6,000	3,000
Lower Kentucky	25,000	15,000	62,000	40,000
Total	**340,000**	**135,000**	**113,000**	**60,000**

* 2002 estimate, actual acreage may vary

TM (2): How does the road system affect managing the suitable timber base and other lands?

Management of the suitable timber base is not possible without roads. Helicopter logging is the only method that can occur where road access is minimal. Historically, helicopter logging has not been feasible on the Daniel Boone National Forest because of insufficient timber quantity and quality. Roads need to be in locations to accommodate logging systems and harvest methods. Where timber harvesting is used on other than suitable lands to accomplish other resource objectives, a road system is needed. However, based on site-specific conditions, longer skidding distances can be used and more protective measures applied to accomplish the project objectives. These additional measures would result in additional logging costs and lower timber receipts.

Generally, if an area has not yet been accessed, the timber value is less than the cost of an access road. Therefore, any currently inaccessible timber on the Forest is probably on land unsuitable for timber production.

TM3: How does the road system affect access to timber stands needing silvicultural treatment?

Silvicultural treatments that have recently (within 5 years) occurred on the Forest generally include mostly chain-saw felling, back-pack herbicide stand improvement, prescribed burning, hand tree planting, and hand-applied herbicide for release of seedlings. Of this work, 95% has been in timber sale units having existing temporary roads. Access is good and crews usually can drive high clearance or 4-wheel drive vehicles to the edge of the work area. Obviously, where good access is available to the work area, less time is spent in travel and more time can be spent working on the project.

Where roads access timber stands in need of silvicultural treatments, it is more likely that the work will be accomplished. Efficiency in management occurs when roads are present. Contractors are much more interested in work near roads and will do the work at a more reasonable price. In general, road needs are similar to TM (1).

Minerals Management (MM)

MM (1): How does the road system affect access to locatable, leasable, and salable minerals?

The Daniel Boone National Forest has no locatable minerals of interest, minor salable minerals and much interest in leasable minerals. On the Daniel Boone national Forest private minerals (reserved or outstanding), makes up the majority of the minerals ownership and minerals activity.

Since the American public is highly dependent on mineral resources such as oil, gas and coal, these resources have been made available on National Forest System lands. However, the extraction of minerals from the Forest can impact soil and water, flora and fauna, and the scenery resources.

The road system affects minerals on the Forest in several ways. Since private minerals rights make up a large portion of our ownership, we are obligated to provide those mineral owners access to their property. Therefore, the roads will be refurbished or created to provide this access. Generally, the road system provides adequate access to most of the Forest, where short "spur" roads will usually get operators where they need to be.

Many areas of the Forest have older or user-developed roads that are not in compliance with 1985 Plan standards and guidelines. This creates a difficult road management situation. Forest roads have different parties responsible for maintenance. This leads to different levels of maintenance and disrepair. The Forest also has many unclassified roads, several of which are located in undesirable locations and are not being maintained. The mineral operators interpret this lack of management as silent approval to use roads that are available on the Forest. This presents difficult negotiations for private mineral projects when the general public uses these unacceptable roads, while we recommend the mineral operators build an expensive new road.

Range Management (RM)

RM (1): How does the road system affect access to range allotments?

Currently, there are no active range allotments on the Forest. The need for road access to any future range allotments would be determined during project development.

Water Production (WP)

WP (1): How does the road system affect access, constructing, maintaining, monitoring, and operating water diversions, impoundments, and distribution canals or pipes?

This is not an issue at the Forest level.

WP (2): How does road development and use affect water quality in municipal watersheds?

Road development and use in watersheds used to supply domestic water may affect the water quality.

Analysis of the effects of roads on water quality must consider processes and conditions across scales. Effects will best be determined at the watershed scale, sub-watershed scale or project level.

WP (3): How does the road system affect access to hydroelectric power generation?

This is not an issue on the Daniel Boone National Forest.

Non-timber Forest Products (NT)

Numerous non-timber forest products are collected from National Forests. These are transformed into herbal medicines, decorations, natural foods, and other products. All contribute to a multibillion-dollar per year industry. In many cases, the income from this business is critical to making a living. Roads are necessary to provide access to the materials that are collected. In some cases, the ease of reaching collecting sites, i.e., the kind and distribution of roads present, means the difference between making and losing money. Roads may help managers direct collection pressure to specific bounded areas to help with permit compliance and resource management. At the same time, roads contribute to the poaching of these same forest products and can increase the workload of resource management.

Forest Specific: While not a commonplace occurrence, at least under permit, the Forest has received requests for, and occasionally granted permits for pickup truckloads of sheet moss and other products. In these cases, roads directly affect where these activities will take place, with either positive or negative effects on the resources.

Measures: It is unknown at this time how to measure this variable. However, a starting place is to return to specific product listing on permits. Currently, for botanicals, only ginseng is specifically listed. All others are lumped under roots or something similar. It is not possible to know what species are receiving collection pressure under this system, and in turn not possible to even begin to address the effects of roads on these species based on known habitats and known routes.

NT (1) – How does the road system affect access for collecting non-timber forest products?

Where non-timber forest products can only be gathered close (within 20 feet) to a road, approximately 1% of the Daniel Boone National Forest is available for that purpose. Where non-timber forest products can only be gathered within 500 feet of a road, approximately 32% of the Forest is available for that purpose (Table 14). Most of the non-timber forest products collected on the Forest are botanicals. Distance to a road is seldom a concern, and collectors regularly walk 0.5 mile or more from a road to gather the Non-timber Forest Products. There is a benefit in collecting further from a road in that highly sought after species are more likely to be found.

Table 14: Road accessibility for non-timber forest products, DBNF

Management Area	**"Close" land within 20' of road (acres)**	**"Medium" land within 500' of a road (acres)**
Licking	1,300	115,000
Cumberland	5,000	30,000
Upper Kentucky	1,000	23,500
Lower Kentucky	1,600	38,000
Total	**8,900**	**206,500**
Percent of 648,000 ac.	**1.4%**	**31.9%**

(Actual acreage may vary)

Definitions

cable logging – removal of trees or logs from a stump to a landing site using a yarder.

ground-based logging – removal of trees or logs from a stump to a landing site using equipment or animals that move across the ground on skid trails.

forest products – any plant material grown in a forest that is made available for human use. Includes both timber (roundwood) products and non-timber products such as mushrooms.

harvest method – a procedure by which a stand is logged; emphasis is on meeting logging requirements while concurrently attaining silvicultural objectives – *synonym*-cutting method (Helms 1998).

isolated tracts – An area that is 250 acres or less in size and is further than ¼-mile from a road.

***leasable minerals* -** A legal term that for Federally owned lands, or Federally retained mineral interest in lands in the United States, defines a mineral or mineral commodity that is acquired through various Acts of Congress. Leasable minerals include oil, gas, sodium, potash, phosphate, coal, and all minerals within Acquired Lands.

***locatable minerals* -** A legal term that defines a mineral or mineral commodity that is acquired through the General Mining Law of 1872, as amended. These are the base and precious metal ores, ferrous metal ores, and certain classes of industrial minerals.

logging system – type of equipment - ground-based, cable, or aerial.

road – a travelway, for vehicles that are greater than forty inches in width.

***salable minerals* -** A legal term that for Federally owned lands, defines mineral commodities that are sold by sales contract from the Federal Government. These are generally construction materials and aggregates such as sand, gravel, cinders, roadbed, and ballast material.

silvicultural system – a planned series of treatments for tending, harvesting, and re-establishing a stand (Helms 1998).

special-use authorization – a term permit, temporary permit, lease, easement, or other written instrument that grants rights of privilege of occupancy and use, on National Forest System land, subject to specified terms and conditions.

suitability – The appropriateness of applying certain resource management practices to a particular area of land, as determined by an analysis of the economic and environmental consequences and the alternative uses foregone (36 CFR 219.3).

suitable timber base/suitable lands – National Forest System lands that have been determined to be capable, available, and suitable for timber management.

timber harvesting – the felling, skidding, on-site processing, and loading of trees or logs onto trucks – *synonym* logging (Helms 1998).

Special Use Permits (SU)

Background

The general direction in the existing Daniel Boone National Forest Land and Resource Management Plan for non-recreational Special Uses is "allow permitted uses of National Forest lands only when in the public's interest, are compatible with National Forest management objectives and resources and cannot be served on private land". The typical, non-recreation special-use permits are for utility corridors, and some type of road use. How the permitted use is going to be accessed, how that route is going to be maintained and for what duration is generally addressed in the individual NEPA document.

SU (1): How does the road system affect managing special-use permit sites (utility corridors, communication sites, etc.)

There does not appear from our employees, concessionaires or permittees that there are any major problems with the current road system. The concessionaires operate highly developed sites that were well planned, including adequate access. Outfitter/guides appear to be satisfied with the access to the areas they desire to use and we have not heard of any major problems from our permit administrators of any access problems related to permit oversight.

To determine specific issues regarding special-use roads, this question is more appropriate at the project level.

General Public Transportation (GT)

GT (1): How does the road system connect to public roads and provide primary access to communities?

This is not an issue for the FS jurisdiction road system, as all of these roads are classified as local roads by the State. The Daniel Boone Inventory identifies local, arterial and collector roads in the system. These arterial and collector roads link the Forest local roads to other jurisdiction roads at the government property line. The Daniel Boone has 37 miles of arterial, 410 miles collector and 888 miles of local roads. Other public jurisdiction roads provide access to communities.

The Forest has several isolated tracks of land that still do not have any road access to get to them. There is a need to obtain rights-of- way to these tracts to legally access them for inventory, monitoring and management purposes. There are also tracts of land that have portions of the area cut off from the rest by natural barriers such as clifflines or waterways. These isolated areas will require acquisition of rights-of-way to legally access them for inventory, monitoring and management purposes. The specific need for access can best be determined by a watershed or site-specific level of analysis.

GT (2): How does the road system connect large blocks of land in other ownership to public roads (ad hoc communities, subdivisions, in holdings)?

Public access is primarily over other public agency roads (arterial and collector). The Forest's roads provide access to government land. The Forest has a growing number of special use roads that access small private in-holdings.

GT (3): How does the road system affect managing roads with shared ownership or with limited jurisdiction (RS 2477, cost-share, prescriptive rights, FLPMA easements, FRTA easements, COT easements)?

This is not an issue as the Forest does not share ownership or have limited jurisdiction on any roads in our system. The Forest cost shares with the local public agencies on maintenance projects, which benefit the Forest, although the Forest does not have jurisdiction over these roads.

GT (4): How does the road system address the safety of road users?

On the arterial and collector roads under another public agency's jurisdiction, safety is that agency's responsibility. The Forest has entered cost share agreements to improve roads not under its jurisdiction, but benefit from the improved access to the Daniel Boone National Forest. National Forest System roads that are open to the public for standard passenger cars are subject to the Highway Saftey Act and shall apply the selected elements of the Highway Safety Program Standards. (23 CFR Part 1230).

Administrative Use (AU)

AU (1): How does the road system affect access needed for research, inventory, and monitoring?

People interested in conducting research on the Daniel Boone National Forest have not identified roading as an issue. We believe that our public road system, including state and county roads, is adequate for research, inventory, and monitoring access.

AU (2): How does the road system affect investigative or enforcement activities?

Unlawful activities are often centered on road issues. Illegal use of closed roads, unauthorized collecting of forest products, arson fires, and trash dumping along roads are just a few of these activities. However, the same open and closed roads that provide access for illegal activities on the Forest are the roads utilized by law enforcement to investigate these activities.

The road system provides access to the Forest for a variety of purposes. Illegal activities will occur with or without roads.

Specific roads and how they affect law enforcement activities are more appropriate at the project level.

Protection (PT)

PT (1): How does the road system affect fuels management?

On DBNF, fuels management consists of various hand, mechanical or chemical methods of removing and/or dispersing woody vegetation. Methods specifically include chain sawing, mulching, grinding, spraying with herbicides and generally spreading fuels across the landscape to minimize their buildup. Fuels management also includes prescribed burning, with or without the other treatments. The primary objectives are hazard fuel treatment and resource management.

Hazard fuel treatment has become an important issue on the Forest over the last several years. Ice and storm damage in 1998 coupled with the recent southern pine beetle infestation have increased the forest fuel load to dangerous levels in some areas. While fire has been widely recognized as playing an important historical role in shaping the forest vegetation, the increased fuel loading (as much as 17-40 t/a in some areas), when dry, increases wildfire intensity and is a severe impediment to fireline construction, fire control and protection of adjoining lands. In many areas requiring fuels management, fuels must be reduced through mechanical treatment prior to prescribed burning. Mechanical fuels treatments depend on existing road access. Additionally, road systems can be utilized to provide for effective barriers during the ignition and holding stages of prescribed burning.

PT (2): How does the road system affect the capacity of the Forest Service and cooperators to suppress wildfires?

Historically, road systems have provided for an efficient transportation route for an appropriate fire suppression response on the Forest. Road systems are vital when defining strategies and tactics that are the most cost-effective commensurate with objectives for management areas in which fires occur. The level of fire suppression efficiency on the Daniel Boone National Forest was measured using an analytical process known as the National Fire Management Analysis System (NFMAS) in 2001. NFMAS objectively measured the net value change between the fire protection program, fire related cost, and resource losses on the Forest. This process identified the most efficient level of organizational needs for fire protection and proposed the most efficient funding level for the Forest's fire protection organization. Funding appropriated for fire preparedness and pre-suppression is directly connected to the outputs of this analysis and these outputs are in part determined by the access provided by the existing road system.

Efficiency of transportation by emergency and other vehicles on Forest road systems played a key role in the NFMAS process. Due to a high road density on the Forest, vehicles are utilized as the primary mode of transportation. To a large extent, the existing road system has molded the intensity and extent of fire suppression activity, and the agency's ability to fight fires effectively within certain areas. It might be worthwhile to examine the correlation if any between fire size, road access, and suppression costs. It seems logical to infer that fires having easier access would be controlled quicker and thus be kept smaller and cost less. However, along this same line of reasoning it should be noted that some studies suggest that public and commercial road access are thought to lead to increased wildfire arson ignitions. Therefore, gating or barricading roads to limit public access might in fact decrease the number and frequency of ignitions and thus reduce the suppression figures. If road access is restricted to administrative use, provisions must be made for annual cleanout so as to insure availability when needed.

The general direction of the Forest Land Management Plan directs that the minimum road required for resources be built when necessary and with regards to road maintenance. Land managers are to perpetuate the level of service required of a facility to respond to the management objectives, protection of investments and resources, and user safety and efficiency.

Roads have long proved useful in fire suppression by being used as fire lines and are considered as having some value in isolating and breaking up the continuity of fuel beds. However, limiting the spread of fire using roads alone does not generally work without additional dozer or handlines.

The effects of an organized and effective road system in the suppression of wildfires as well as meeting other management objectives is indisputable, however, all roads are not created equally. Road location and slope position, relative to the values at risk and the presence of hazards, should form the basis for assigning the values to specific roads.

PT (3): How does the road system affect risk to firefighters and to public safety?

Safety, in relation to road systems and travel management on the Forest, along with all other safety considerations, will be highest priority for firefighters and the public. When considering fire responses to wildland fires, fire managers along with firefighters need to identify tactics and strategies that do not compromise the safety of the firefighters. Issues such as road surface type and condition, road clearances, visibility of roadways on corners, maintenance levels, and traffic levels are just a few of the safety or possible safety issues emergency vehicle drivers deal with when responding to wildland fires.

Another area of concern is the interface between urban and forest lands. Many homeowners are building access roads to private residences that will not accommodate large emergency vehicles or have inefficient ingress or egress. An assessment for effects on urban interface will be completed at the local level where public comments and information can be utilized to make site-specific evaluations.

Unroaded Recreation (UR)

Background

The current 1985 Forest Land and Resource Management Plan has an objective of providing a diversity of recreation opportunities to the public. From public input and our observations our niche seems to be in semi-primitive opportunities that are not as readily available to the public on private lands. This niche is in "dispersed" recreation activities that require large tracts of land such as hunting, boating, mountain biking, OHV riding, horseback riding, and backpacking. It also includes opportunities to experience the unique natural settings and experiences that are provided in National Forest wildernesses, proposed Wild and Scenic Rivers, the Red River Gorge Geological Area (which includes Clifty Wilderness and the Red River Wild and Scenic River) or on the Forest's two large lakes.

Forest recreation opportunities involving developed recreation facilities such as picnic areas, interpretive sites, overlooks, shooting ranges and campgrounds, the public usually requires access through a good improved road system while the more primitive recreation opportunities do not require this higher level of access.

Maintaining adequate and appropriate access through our road system is essential to the public and the Forest in meeting both our goals and objectives. The key is in understanding what the minimum level of roading is that will provide good access while maintaining the type of ROS setting desired by the public. Too many roads, too large of a road or improper road location, may detract from the recreation experience through excessive noise, over-crowding or the negative visual impact of the road itself. However, inadequate roading may deter the public from experiencing a quality recreation experience, or create an unsafe driving situation.

For simplicity, dispersed recreation activities are generally considered "unroaded" recreation opportunities and developed recreation activities are generally considered "roaded" recreation. With most vacation times shortening and many limited to extended weekends, the extent of unroaded access to dispersed recreation opportunities is limited by the time available. Hikers and even backpackers need to reach their objectives in a day or less. Many people seek the dispersed experience of visiting a waterfalls or a natural arch but with short hikes that require less than a half-day or only a mile or so of hiking. Even rock climbers wish to reach their climbing area as quickly as possible. Deep penetration into remote areas for extended periods of time has become less common.

UR (1): Is there now, or will there be in the future, excess supply or excess demand for unroaded recreation opportunities? (Unroaded areas = areas that do not contain NFS classified roads.)

Over the majority of the Forest there is no excess demand for recreation opportunities in unroaded areas, in fact there is usually an over supply of unroaded recreation opportunities. However, in certain places, primarily during summer weekends and holidays, there is excess demand for unroaded recreation opportunities. These conclusions are based on the recreation use observations of Forest Service employees and informal public input.

It should be pointed out that unroaded recreation opportunities in the semi-primitive ROS do not necessarily mean that the activities must occur in large, unroaded tracts of National Forest land. Except for wilderness areas, good quality, unroaded opportunities for most people who recreate on this Forest mean that they do not see open roads (closed, brushed-in roads are usually acceptable), do not perceive much human activity or do not hear traffic while engaged in their recreational pursuit. In addition, they usually do not desire many encounters with others not in their group during their outing. Such unroaded experiences can be achieved in fairly narrow corridors in semi-primitive ROS settings, even though roads, some past human activity (such as old logging) and other developments might be nearby. Depending on the type of activity these corridors may be less than 1/10 of a mile wide. This is primarily true of trail recreation opportunities.

The primary places and activities where excess weekend and holiday demands mentioned above are:

Red River Gorge Geological Area (RRGGA) - Hiking, rock climbing, primitive camping. These activities occur primarily during weekends in the spring and fall. Mid-summer heat and insects tend to reduce these activities. While rock climbing may occur in semi-primitive environments, our experience and discussions with rock climbers indicates that they can, and do, tolerate a greater degree of social interaction.

Cave Run and Laurel River Lakes - Boating, sailing and general day use trail activities. (Note: It is questionable whether these lakes should be considered "unroaded". They certainly are not "semi-primitive" on their open water areas due to the heavy motorboat traffic.)

Certain Forest trails - Horseback riding, mountain biking and OHV riding. These trails usually are long enough (10 miles+) and safe enough to make a trip from home worthwhile. They are also in locations where there is adequate access and safe parking.

The current National Recreation Use Survey being done on the Forest and the public scoping done in conjunction with the Forest Plan revision will help provide a better idea of the types and amount of recreation occurring on the Forest and information on the satisfaction of our recreation users. In addition, recreation use and satisfaction surveys for Cave Run Lake and Laurel River Lake can provide good information for these lakes. However, data for use and access for our wilderness areas, proposed Wild and Scenic Rivers, and the RRGGA are not adequate. Public use and demand is determined through a Limits of Acceptable Change (LAC) process and use surveys at the district level.

Data for projecting long-term trends for unroaded recreation opportunities on the Forest are limited by the term unroaded and its present variable definition. SCORP studies and national trend studies can be sources of data for rough predictions of what might occur for wilderness and back country camping.

UR (2): Is developing new roads into unroaded areas, decommissioning of existing roads, or changing the maintenance of existing roads causing substantial changes in the quantity, quality, or type of unroaded recreation opportunities?

The primary road system for this Forest is pretty much already in place. Additional roading would mostly be in the form of smaller, temporary roads to access land for managing for a desired future condition, or the temporary reopening of closed system roads for such purposes. A substantial change in the unroaded recreation opportunities due to changes in the current road system are not expected.

UR (3): What are the adverse effects of noise and other disturbances caused by developing, using and maintaining roads, on the quantity, quality and type of unroaded recreation opportunities?

During the weekdays and winter there should be little in the way of adverse effects of noise and other disturbances on existing unroaded recreation opportunities in our Wilderness areas and the RRGGA. In addition, Wilderness regulations and terrain severely limit additional roading in these areas. However, as stated in UR(1) crowding on weekends and holidays exists in certain areas and road access contributes to this. Along the outer edge of the RRGGA, where there are good state roads, this over crowding has contributed to damage and loss of archeological sites and white-haired goldenrod sites. It is impractical to close these roads so other management strategies will be needed to control damage and over-crowding.

In areas outside of the RRGGA and wildernesses, if temporary roads were to be opened and converted to larger, open roads, there would be adverse effects on certain trails and some popular hunting areas. Depending on the hunting areas and trails involved, and the level of road related activity, the adverse effects could reduce use or change the type of recreation activity. Specific determinations for such impacts should be done at the watershed or project level.

UR (4): Who participates in unroaded recreation in the areas affected by building, maintaining and decommissioning roads?

Wilderness users (hikers, campers, rock climbers), all types of non-wilderness trail users, rock climbers, hunters and non-motorized boaters (sailing, canoeing, kayaking) are all affected by these road activities.

UR (5): What are these participants' attachments to the area? How strong is their feeling? Are alternative opportunities and locations available?

Most non-wilderness trail participants have less of an attachment to a particular area than they do for their sport. This may not be as true of folks who live very near a forest area where they recreate. Ease of access may be crucial to them but the desire to explore other areas would seem to mitigate a strong attachment if good quality recreation alternatives can be found. In most cases there are probably some potential for alternatives if roading adversely impacts an area.

Rock climbing in the RRGGA is very much a source for strong attachment by rock climbers due to its reputation as an internationally known climbing area. It has yet to be seen if there are other areas on the Forest that can provide the quality of climbing provided by the RRGGA, and if such an area is found, can it draw climbers whose priority may be to bolster their reputation and pride by boasting they have "climbed in the Gorge". We should work with the climbing community to locate alternatives to the crowding and resource damage that is occurring in the RRGGA. Rock climbing use has increased tremendously in the past five years and is expected to continue to increase in the near future as climbing becomes more popular and the Gorge's reputation spreads.

Boating and wilderness use are necessarily limited to a few, defined areas. Attachments to an area by participants are primarily due to ease of access, closeness to home and familiarity with an area. Three studies of the boating and recreation use of Cave Run and Laurel River Lakes are a source of information to help us analyze these opportunities. Wilderness use attachment is probably a function of how close an area is to home and, in the case of Clifty, its reputation as a quality-climbing portion of the RRGGA.

Roaded Recreation (RR)

RR (1): Is there now or will there be in the future excess supply or excess demand for road-related recreation opportunities?

Roaded recreation opportunities follow a similar use and supply pattern as unroaded recreation. There is an excess supply for most of our developed recreation sites, especially during the weekdays. However, there are certain places in the RRGGA and our two lakes were there is excess demand during weekends and holidays from spring to fall. In the RRGGA many of the trailheads, the Gladie Interpretive Site and Chimney Top and Sky Bridge Observation areas are especially crowded during holidays and weekends. At Cave Run and Laurel River Lakes the campgrounds and boat ramps are also crowded during the summer holidays and weekends. ROS in these areas range from "Roaded Natural" in the RRGGA to "Urban" at the larger lake campgrounds. While there is both an over supply and excess demand for road-related recreation opportunities there seems to be a balance that is economically reasonable (i.e., we cannot afford to build and maintain facilities to accommodate all the possible weekend use and then have these facilities set almost empty during the weekdays) but we do have opportunities to move some of the demand from the weekends to the weekdays. With this in mind access seems to be adequate and appropriate for these more developed road-related recreation opportunities.

RR (2): Is developing new roads into unroaded areas, decommissioning of existing roads, or changing maintenance of existing roads causing substantial changes in the quantity, quality or type of roaded recreation opportunities?

There is not much change in our primary road system status that impact roaded recreation opportunities so few changes are occurring. In addition, there does not appear to be a public need for any particular change in roaded recreation opportunities that could be affected by roads. Any changes in roaded recreation opportunities from road changes are best analyzed at the watershed or project level.

RR (3): What are the adverse effects of noise and other disturbances caused by constructing, using and maintaining roads on the quantity, quality or type of roaded recreation opportunities?

With the few changes in our road system there does not appear to be much in the way of adverse effects on roaded recreation opportunities. Any changes in roaded recreation opportunities from road changes are best analyzed at the watershed or project level.

RR (4): Who participates in road related recreation in the areas affected by road building, changes in road maintenance or road decommissioning?

Campers and boaters along with folks just site seeing and driving for pleasure are the vast majority of participants involved in road related recreation activities. Picnickers and others using developed recreation facilities not previously mentioned make up the remainder of the participants. The National Recreation Use Survey we are currently conducting will provide the Forest with a good, statistical breakdown of these participants.

RR (5): What are these participants' attachments to the area. How strong are their feelings and are alternative opportunities available?

As with UR (5), the most attachment to an area relates to its ability to provide the participant with the recreation opportunity they desire or its nearness to the participant's home. The developed areas on the Forest usually tie to a specific natural setting (i.e., lake, cliffline, river, etc.) which, for this Forest, are not easily duplicated elsewhere. From public input, we can tell that people having strong attachments to these areas use the major recreation facilities. Studies at Cave Run and Laurel River Lakes provide good information on boaters' attachments to the facilities, as does the marketing study for Zilpo Campground.

Passive-Use Value (PV)

PV (1): Do areas planned for road building, closure, or decommissioning have unique physical or biological characteristics, such as unique natural features and threatened or endangered species (see TW4)?

Site-specific project analysis is the level this should be determined.

PV (2): Do areas planned for road building, closure, or decommissioning have unique cultural, traditional, symbolic, sacred, spiritual, or religious significance?

Site-specific project analysis is the level this should be determined.

PV (3): What, if any, groups of people (ethnic groups, subcultures, etc.) hold cultural, symbolic, spiritual, sacred, traditional, or religious values for areas planned for road entry or road closure?

The following passive values are identified: Indian sacred sites, cemetery access for relatives of the deceased; use of traditional dispersed camping, picnicking and visitation spots by family and friends that were raised or had families that owned and worked land within the present National Forest; preservation of NFS land by environmental activists; and spiritual renewal values of NFS land by visitors.

PV (4): Will building, closing, or decommissioning roads substantially affect passive-use value?

Site-specific Project analysis is the level this should be determined.

Social Issues (SI)

SI (1): What are people's perceived needs and values for roads? How does road management affect people's dependence on, need for, and desire for roads?

Roads in the mountains of eastern Kentucky were hard to come by in the past. The Daniel Boone National Forest lies within 21 of the historically poorest counties in Kentucky. Many of the original communities and homes were originally accessed by railroad or horse trail. When the railroads pulled out, the railroad bed was converted to a primitive road. Gradually some of the horse trails were converted to wagon routes and eventually roads. This is why so many roads are still crooked and winding. They were built from one home to another, usually along property lines. Over a hundred years ago some counties had what was called "Court Days" which was the last day of court in the fall when the roads would still be in good enough shape for the people of the county to get together to do business and conduct court. Improvements were slow due to the subsistence existence of the local population. The lack of a strong tax base is compounded by the high cost of road construction, upgrading and maintenance of roads in eastern Kentucky. The people of eastern Kentucky still place a very high value on even the most primitive of roads.

Many believe that roads and the use of roads or travel ways causes little environmental impact. Many feel that closing or eliminating roads would deny the public full use and enjoyment of public lands.

SI (2): What are people's perceived needs and values for access? How does road management affect people's dependence on, need for, and desire for access?

To be enjoyed and appreciated by visitors, the Forest must be accessible. Many of the state and county roads that provide access to NFS land also provide access for residents to their communities where they work and purchase goods and services. Closure of unneeded roads also provides public service. Closure of unneeded roads would reduce sights and sounds of motor vehicles, improving the experience for people who desire solitude. Public attitudes toward the FS and roads on NFS lands are diverse and often very contentious. In general, local residents oppose road closures; however there are local exceptions.

Many citizens have a very strong feeling of entitlement when it comes to accessing the Daniel Boone National Forest. The National Forest has been the recreational center of the local communities. Family gatherings, many homes, cemeteries, camping, picnicking, hunting and fishing areas are now part of the National Forest or are within the present National Forest boundary. Access is important for revisiting areas that have a very strong sense of place for these people who were born, raised or visited these areas in the past. They wish to bring their family to rekindle the feelings and emotions they have and want to pass this on to their children. Their visit may be for just a coupled of hours, a day or a week. They expect the same access or better access when they return to the Forest.

SI (3): How does the road system affect access to paleontological, archaeological, and historical sites?

Access as a result of the Forest's road system may have both positive and negative affects to archeological and historical sites. One positive effect is an increase in the ease of monitoring the sites. Another is the ability to develop roadside interpretive facilities to better accommodate disabled and elderly persons.

The negative effects include an increased potential for looting and vandalism to irreplaceable heritage sites. Prohibiting additional roaded access would reduce the potential for disturbance, vandalism, and looting; and the character of the heritage resource would be better maintained. The possibility of damage to heritage resources by project-related activities does not exist if there isn't a project or road.

SI (4): How does the road system affect cultural and traditional uses (such as plant gathering, and access to traditional and cultural sites) and American Indian treaty rights?

There are no known American Indian treaty rights on the Daniel Boone National Forest. Very few places on the Daniel Boone are more than two miles from a public road.

SI (5): How does road management affect roads that constitute historic sites?

Roads that are historic should be valued and protected as much as any other historic property. Section 106 of the National Historic Preservation Act provides a mechanism for assessing a historic road's significance, minimizing impacts to the road and determining the appropriate mitigation measures for an activity that would affect the site. The historic nature of a road would not be grounds for closure. However, management activities including reconstruction may not be allowed unless the reconstruction is to mitigate environmental damage or for reasons of public health and safety.

SI (6), SI (7): We combined questions SI (6) and SI (7) to read, "How are community social and economic health affected by road management and management of unroaded areas (for example, lifestyles, businesses, tourism industry, infrastructure maintenance)?

A legacy of historical factors, such as the economic depression of the 1930's, partially explains why the Daniel Boone National Forest was established, why it has a scattered ownership, and why socio-economic and cultural characteristics vary so much across the region.

Across the eastern Kentucky region, road access to public lands is important to lifestyles. These lifestyle activities include: driving to work, family gatherings, picnicking, driving to special spots, boating, camping, fishing, horseback riding, and hunting.

The economic composition of our regional community depends on a well-maintained road transportation network. Winding curvy roads that require slow speeds to be safe isolates homes and communities. The existing arterial and collector roads are an adequate transportation system to support the present commuting patterns. Improvements in the present network would provide an improved infrastructure that would provide for economic growth and improve the economic stability of the area.

Some counties have only one or two industries and if an industry closes, half or more of the people employed in the county are out of a job. Many people must go outside the county for employment. Most hospitals serve a regional or multi-county area. Some county seats provide health and retail services for several adjacent counties.

The trend in outdoor recreation is away from extended one or two week vacations to weekends or extended three-day weekends. Tourism and visits to unroaded areas are limited by the isolation of the unroaded areas in eastern Kentucky.

SI (8): How does road management affect wilderness attributes, including natural integrity, natural appearance, opportunities for solitude, and opportunities for primitive recreation?

Roads accessing isolated property and homes in eastern Kentucky directly affect the attributes identified above. Watershed and site-specific analysis better identifies the affect roads have on the limited semi-primitive areas on the Forest.

SI (9): What are traditional uses of animal and plant species in the area of analysis?

Plant and animals of the Daniel Boone National Forest continue to be used for food and income in the subsistence economy of eastern Kentucky. The proportion of the population using plants and animals for food and income is decreasing, but such use still remains important to the local community.

SI (10): How does road management affect people's sense of place?

This question relates to very specific locations on the Forest. These places need to be identified by the public as to their location and what it is about the specific location that gives the person the attachment. "Sense of place" describes the character of an area and the meaning people attach to it. It integrates the interpretations of a geographic place, considering the biophysical setting, psychological influences (memory, choice, perception, imagination, emotion), and social and cultural influences. Changes in road management can affect access to these places or change the biophysical setting, affecting what people value. We have not identified an area or place where this is an issue.

Civil Rights and Environmental Justice (CR)

CR (1): How does the road systems, or its management, affect certain groups of people (minority, ethnic, cultural, racial, disabled, and low-income groups)?

Usually environmental justice is not an issue unless the percent of minority population or low-income population exceeds twice the state average. The 21 counties within the Daniel Boone National Forest are all less than twice that of the state of Kentucky: 2.69% minority and 31.1% low income (US Census Bureau 2000). This demographic information indicates that these counties are not qualified as environmental justice communities. Therefore, we believe the road system has no more or no less affect on certain groups of people than on any other group of people. All groups use the road system. Changes in road management including closing or decommissioning of any of the roads would have the same effect on all groups including minorities and different cultures.

Step 5 – Describing Opportunities and Setting Priorities

The section below answers five specific questions from pages 31 and 32 of *Roads Analysis: Informing Decisions About Managing the National Forest Transportation System*. These questions helped capture potential opportunities for the road system on the Daniel Boone National Forest.

1. Question: Does the existing system of roads create an unacceptable risk to ecosystem sustainability?

<u>1a. Opportunity:</u> Past and present budgets have been inadequate to properly maintain the existing road system as classified.

Recommendation: The following should be evaluated at the watershed or site-specific level and prioritized by the presence of PETS species, but should be done Forest-wide.

- Consider reclassifying the maintenance level and management objectives of some existing roads so that budgets are adequate to properly maintain roads to the maintenance level and management objective classification.
- Take advantage of developed GIS layers to closely consider the need and placement of new roads or the closure of existing roads in relationship to rare communities and species.

<u>1b. Opportunity:</u> The existing inventory of the Forest road system does not identify all existing roads on the Forest. This is due to many reasons, most notably – uncertain ownership/maintenance responsibilities, the legal status of public passageways, unclassified roads not yet inventoried and classified for retention or obliteration. Many of these roads are directly affecting ecosystem sustainability. Unclassified motorized routes 50 inches or less create the same effects to ecosystem sustainability as unclassified roads greater than 50 inches with similar traffic and design problems (see AQ 1, 2, 4, 6, 9, 10, 11, 12, and 14).

Recommendation: The following should be evaluated at the watershed or site-specific level and prioritized by the presence of PETS species, but should be done Forest-wide.

- Place all existing travelways in the roads map layer and roads database, including: roads that touch NFS land; roads that provide access to NFS land; and within the purchase unit boundaries within the Forest boundary.
- Identify all unclassified roads and eliminate or classify, and insure some entity is responsible for their maintenance (see AQ 1, 2, 4, 6, 9, 10, 11, 12, and 14).
- Meet with other regulatory agencies (e.g. county, state) – determine once and for all who will be responsible for the road.
- If agreement can't be reached – close and/or obliterate.
- Where agreement is reached – bring to standard.

1c. Opportunity: Minimize sediment introduction in streams (see AQ 1, 2, 4, 6, 9, 10, 11, 12, and 14).

Recommendations: The following should be evaluated at the watershed or site-specific level and prioritized by the presence of PETS species, but should be done Forest-wide.

- Survey all roads on the system at stream intersections or close approaches to streams and bring the roads up to standard if necessary.
- Move roads out of high-risk areas such as riparian areas, near rare communities, archeological sites, etc.
- Reduce the number of road/stream crossings and the miles of road within 100 feet of streams. This is especially true in watersheds #19 and 29 (see AQ #6).
- Conduct watershed scale roads analysis in watersheds that are susceptible to slope failures due to the amount of roads on unstable geology (see AQ #3).

1d. Opportunity: Stop the introduction and spread of exotic species.

Recommendations: The following should be evaluated at the watershed or site-specific level and prioritized by the presence of PETS species, throughout the Forest.

- Eliminate exotic species when feasible.
- Modify road-grading standards to include techniques that will reduce the spread of exotic invasive species such as: do not grade shoulders and ditches infested with exotic invasive weeds towards portions of roads without these weeds. Do not push material from shoulders and ditches towards wings at stream crossings or elsewhere.
- Set up and maintain an exotic invasive pests (primarily weeds) monitoring system and database to track changes along the road system.
- Make use of new contractual clauses available for projects along roads to control the spread of weeds along roads from one area to another.
- Use new information and new exotic pest plant lists to help in the selection of appropriate seeds mixtures for road stabilization.

2. Question: Can the maintenance requirements of the existing system be met with current and projected budgets?

(Same as 1a.) Opportunity: Past and present budgets have been inadequate to properly maintain the existing road system, based upon the present maintenance level and management objective classification**.** Reclassify the existing maintenance level and management objective where appropriate and prioritize roads to be closed, or decommissioned, so the expected budget would be adequate to maintain the system.

Recommendations: Follow the recommendation in Question 1a above.

3. Question: Are some existing roads not needed to meet projected access needs?

(Same as 1a.) Opportunity: This should be evaluated at the watershed or site-specific project level.

4. Question: If new access is proposed, what are the expected benefits and risks?

4a. Opportunity: New roads are going to be proposed. This should be evaluated at the site-specific or watershed level. Approximately 20 miles of new road construction may be needed in the next ten years Forest-wide with most needed on the Redbird District. It is estimated that 150 miles of road will need to be repaired or decommissioned in the next ten years Forest-wide.

5. Question: What opportunities exist to change the road system to reduce the problems and risks or to be more consistent with Forest Plan direction and strategic intent of the roads system?

5a. Opportunity: Evaluate existing roads and determine if the road is in the wrong location.

5.b Opportunity: Some existing roads do not meet current standards.

5c. Opportunity: Need to coordinate the maintenance of roads maintained by other agencies to better meet the Forest's ecosystem sustainability.

Recommendations: The following should be evaluated at the watershed or site-specific level and prioritized by the presence of PETS species, but should be done Forest-wide.

- All stream crossings should be hardened crossings. This includes, as a minimum, bedrock stream or concrete plank crossings, both with hardened approaches to minimize sediment loading.
- Reduce road densities on slopes greater than 40 percent (see AQ #2). Specific road closures or rerouting would be identified on a "watershed scale".
- Close some roads in areas with high road densities. (See AQ #2). Specific road closures would be identified on a "watershed scale".
- Work with local governments to improve the maintenance level on county roads that are near Forest Service managed lands.
- Survey all road/stream crossings to locate those that adversely impact the movement or migration of aquatic organisms and/or degrade local stream channels or water quality (see AQ 4 and 10). This should be done throughout the Forest but should be evaluated at the watershed level. Make changes where necessary, prioritize based on the presence of PETS species.
- Make a conscience effort to close/obliterate, and/or relocate roads out of the riparian corridors. (Fits well with #1 above).

6. Question: Are additional roads or improved roads needed to improve access for Forest use or protection, or to improve the efficiency of Forest use or administration?

This should be evaluated at the watershed or site-specific level.

Step 6 – Reporting

This final document titled *Daniel Boone National Forest, Forest Scale Roads Analysis,* dated April 5, 2002, consists of the final report for the roads analysis. This document meets all the requirements listed on page 33 of *Roads Analysis Informing Decisions About Managing the National Forest Transportation System* (USDA Forest Service 1999).

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Forest Service Participants

- Richard Wilcox - Forester, Land Management Planner (Team Leader)
    - Certified Professional Forester: Society of American Foresters
    - Recreation Management Short Course: Utah State University 1993
    - Graduate Studies in Recreation Planning: Colorado State University 1968-69
    - MS in Forestry (Outdoor Recreation): University of Michigan 1969
    - BS Forestry: University of Michigan 1967
- James Boyd - Civil Engineer
- Mason Miller – Recreation/Engineering Forest Staff Officer
    - Bachelors in Landscape Architecture: University of Kentucky 1976
    - Registered to practice Landscape Architecture in Kentucky September 15, 1982
- David Taylor - Botanist
- George Chalfant – Soil Scientist
- Jim Bennett – T & E Biologist
- John Omar – Fisheries Biologist, Aquatics Specialist
    - BS Wildlife Management - 5/80 Eastern Kentucky University (EKU)
    - MS Biology (emphasis and thesis in aquatic entomology) - 12/94 EKU
- Dean A. Karlovich – Forester, Fuels Management
    - Associates in Science 1995 - College of Dupage, Illinois
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    - Bachelors of Science 1997 - Forest Resource Management 'Magna cum Laude' - Southern Illinois University
    - Masters of Science 1999 - Forest Resource Management - Southern Illinois University
- Mike Kluempke – Forester, Timber Sales
    - B.S. in Forestry from the University of Minnesota 1973
- Jon Walker – Hydrologist
    - M.S. in Forest Hydrology (1984) from Southern Illinois University
    - B.S. in Forest Management (1982) from Southern Illinois University
- Cory Miller – Geologist
- Victoria Bishop - Fisheries Biologist
- Dick Braun – Forest Biologist
    - Natural Resource Program Management: Utah State University, 1995
    - Leadership and Communications for Natural Resource Managers: Virginia Polytechnic Institute and State University, 1993
    - BS Biology: University of the State of New York, 1992
- Paul Finke – Forester, Silviculturist
    - Certified Silviculturist since 1990
    - B.S. degree in Natural Resource Management, specializing in Forest Management: Ohio State University, 1979
- Beth Buchanan – Fire Ecologist
    - MS, Natural Resources (specialty Plant Ecology): The Ohio State University, 1996
    - Agriculture (major, Animal Science): The Ohio State University, 1992
- Cecil Ison – Archeologist

- Fred Marriott – Dispersed Recreation Specialist
    - BS in Forestry: University of Georgia, 1970.
- Mike Rock – Land, Water, Mineral Program Manager
- L. Amos Stone – Forester, Land Management Planner
    - Certified Silviculturist, USFS-Southern Region: 9/93, recert '97, '01.
    - MS Forestry: Michigan State University, 1988
    - BS Forestry: Purdue University, 1975
- Brian Knowles - Biologist, Land Management Planner
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    - MS, Forest Management, Michigan State University, 1978.
    - BS, Forestry, Rutgers University, 1976

Appendix A: Traffic Service Level Parameters

	Service Levels			
Parameters	**A**	**B**	**C**	**D**
Flow	Free flowing with adequate parking facilities.	Congested during heavy traffic such as during peak logging or recreation activities.	Interrupted by limited passing facilities, or slowed by the road condition.	Flow is slow or may be blocked by an activity. Two-way traffic is difficult and may require backing to pass.
Volumes	Uncontrolled; will accommodate the expected traffic volumes.	Occasionally controlled during heavy use periods.	Erratic; frequently controlled as the capacity is reached.	Intermittent and usually controlled. Volume is limited to that associated with the single purpose.
Vehicle Types	Mixed; includes the critical vehicle and all vehicles normally found on public roads.	Mixed; includes the critical vehicle and all vehicles normally found on public roads.	Controlled mix; accommodates all vehicle types including the critical vehicle. Some use may be controlled to vehicle types.	Single use; not designed for mixed traffic. Some vehicles may not be able to negotiate. Concurrent use traffic is restricted.
Critical Vehicle	Clearances are adequate to allow free travel. Overload permits are required.	Traffic controls needed where clearances are marginal. Overload permits are required	Special provisions may be needed. Some vehicles will have difficulty negotiating some segments.	Some vehicles may not be able to negotiate. Loads may have to be off-loaded and walked in.
Safety	Safety features are a part of the design.	High priority in design. Traffic management accomplishes some protection.	Management provides most protection.	The need for protection is minimized by low speeds and strict traffic controls.
Traffic Management	Normally limited to regulatory, warning, and guide signs and permits	Employed to reduce traffic volume and conflicts.	Traffic controls are frequently needed during periods of high use by the dominant resource activity.	Used to discourage or prohibit traffic other than that associated with the single purpose.
User Costs	Minimize; transportation efficiency is important.	Generally higher than "A" because of slower speeds and increased delays.	Not important; efficiency of travel may be traded for lower construction costs.	Not considered.
Alignment	Design speeds are the predominant factor within feasible topographic limitations.	Influenced more strongly by topography than by speed and efficiency.	Generally dictated by topographic features and environmental factors. Design speeds are generally low.	Dictated by topography, environmental factors, and the design and critical vehicle limitations. Speed is not important.
Road Surface	Stable and smooth with little or no dust, considering the normal season of use.	Stable for the predominant traffic for the normal use season. Periodic dust control for heavy use or environmental reasons. Smoothness is commensurate with the design speed.	May not be stable under all traffic or weather conditions during the normal use season. Surface rutting, roughness, and dust may be present, but controlled for environmental or investment protection.	Rough and irregular. Travel with low clearance vehicles is difficult. Stable during dry conditions. Rutting and dusting controlled only for soil and water protection.

Appendix B: Road Maintenance Level Parameters

	MAINTENANCE LEVEL				
PARAMETERS	**1**	**2**	**3**	**4**	**5**
Service Life	Intermittent Service - Closed Status	Constant Service or Intermittent Service - Open Status (Some uses may be restricted under 36 CFR 261.50)			
Traffic Type	Open for non- motorized uses. Closed to motorized traffic.	Administrative, permitted, Dispersed recreation, Specialized, commercial haul.	All National Forest Traffic - General Use, Commercial Haul		
Vehicle Type	Closed-N/A	High clearance, pick-up, 4x4, log trucks, etc.	All types - passenger cars to large commercial vehicles		
Traffic Volume	Closed-N/A	Traffic volume increases with maintenance level			
Typical Surface	All types	None, Native, or Aggregate -- may be dust abated		Aggregate -- usually dust abated; paved	
Travel Speed	Closed-N/A	Travel speed increases with maintenance level			
User Comfort and Convenience	Closed-N/A	Not a consideration	Low Priority	Moderate Priority	High Priority
Functional Classification	All Types	Local Collector	Local Collector Arterial	Local Collector Arterial	Local Collector Arterial
Traffic Service Level	Closed-N/A	D	A, B, C -- Traffic service level increases with maintenance level		
Traffic Management Strategy	Prohibit or Eliminate	Discourage or prohibit cars. Accept or discourage high clearance vehicles.	Encourage, Accept	Encourage	Encourage

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Appendix C: Documentation Table

The following table was used during Step 4 of the Roads Analysis Process for the Daniel Boone National Forest, Forest Scale Roads Analysis. The 71 questions addressed are from the Roads Analysis Guidebook (FS-643), Appendix 1, Ecological, Social, and Economic Considerations.

All answers to the questions at the Forest level are general and identify potential problems that may occur within general areas. Actual or specific affects can only be positively identified at a watershed or site-specific level. Some questions can only be addressed when site-specific data is known and are therefore outside the scope of this analysis.

The Interdisciplinary team was divided into groups to address specific questions. The groups were:

1. Jon Walker, John Omer, David Taylor, Brian Knowles, Jim Bennett, Dick Braun, George Chalfant, Beth Buchanan, Vicki Bishop
2. Fred Marriott, Mason Miller, Cecil Ison
3. Corey Miller, Paul Finke, George Chalfant
4. Beth Buchanan, Dean Karlovich, Dave Mertz
5. James Boyd

Question	Addressed in Analysis? (Yes/No)	Group responsible for addressing question	Data Beyond Scope of Forest Wide analysis.
Ecosystem Functions and Process (EF) – Page 15			
EF1	No	Group 1	Yes
EF2	Yes	Group 1	
EF3	Yes	Group 1	
EF4	Yes	Group 1	
EF5	Yes	Group 1	
Aquatic, Riparian Zone, and Water Quality (AQ) – Page 18			
AQ1	Yes	Group 1	Areas of concern needs Project or Watershed Level
AQ2	Yes	Group 1	
AQ3	Yes	Group 1	Areas of concern needs Project or Watershed Level
AQ4	Yes	Group 1	
AQ5	Yes	Group 1	
AQ6	Yes	Group 1	Areas of concern needs Project or Watershed Level
AQ7	Yes	Group 1	
AQ8	Yes	Group 1	Areas of concern needs Project or

Question	Addressed in Analysis? (Yes/No)	Group responsible for addressing question	Data Beyond Scope of Forest Wide analysis.
			Watershed Level
AQ9	Yes	Group 1	Areas of concern needs Project or Watershed Level
AQ10	Yes	Group 1	Areas of concern needs Project or Watershed Level
AQ11	Yes	Group 1	Areas of concern needs Project or Watershed Level
AQ12	Yes	Group 1	Areas of concern needs Project or Watershed Level
AQ13	Yes	Group 1	
AQ14	Yes	Group 1	Areas of concern needs Project or Watershed Level
Terrestrial Wildlife (TW) – Page 24			
TW1	Yes	Group 1	
TW2	Yes	Group 1	Areas of concern needs Project or Watershed Level
TW3	Yes	Group 1	Areas of concern needs Project or Watershed Level
TW4	Yes	Group 1	Areas of concern needs Project or Watershed Level
Economics (EC) – Page 27			
EC1	No	Group 5	
EC2	No	Group 5	
EC3	No	Group 5	
Timber Management (TM) – Page 28			
TM1	Yes	Group 3	
TM2	Yes	Group 3	
TM3	Yes	Group 3	
Minerals Management (MM) – Page 31			
MM1	Yes	Group 3	

Question	Addressed in Analysis? (Yes/No)	Group responsible for addressing question	Data Beyond Scope of Forest Wide analysis.
Range Management (RM) – Page 32			
RM1	No	Group 3	No range program
Water Production (WP) – Page 32			
WP1	No	Group 1	Not an issue
WP2	No	Group 1	Best at Project or Watershed Level
WP3	No	Group 1	Not an issue
Non-timber Forest Products (NT) – Page 32			
SP1	Yes	Group 3	
Special Use Permits (SU) – Page 34			
SU1	No	Group 3	Best at Project or Watershed Level
General Public Transportation (GT) – Page 34			
GT1	Yes	Group 5	
GT2	Yes	Group 5	
GT3	Yes	Group 5	
GT4	Yes	Group 5	
Administrative Use (AU) – Page 35			
AU1	Yes	Group 1	
AU2	Yes	Group 1	Best at Project or Watershed Level
Protection (PT) – Page 35			
PT1	Yes	Group 4	
PT2	Yes	Group 4	Areas of concern needs Project or Watershed Level
PT3	Yes	Group 4	Areas of concern needs Project or Watershed Level
PT4	Yes	Group 4	
Unroaded Recreation (UR) – Page 37			
UR1	Yes	Group 2	
UR2	Yes	Group 2	
UR3	Yes	Group 2	Areas of concern needs Project or Watershed Level
UR4	Yes	Group 2	

Question	Addressed in Analysis? (Yes/No)	Group responsible for addressing question	Data Beyond Scope of Forest Wide analysis.
UR5	Yes	Group 2	
Roaded Related Recreation (RR) – Page 39			
RR1	Yes	Group 2	
RR2	No	Group 2	Best at Project or Watershed Level
RR3	No	Group 2	Best at Project or Watershed Level
RR4	Yes	Group 2	
RR5	Yes	Group 2	
Passive Use Values (PV) – Page 40			
PV1	No	Group 2	Best at Project or Watershed Level
PV2	No	Group 2	Best at Project or Watershed Level
PV3	Yes	Group 2	
PV4	No Best at Project or Watershed Level	Group 2	Best at Project or Watershed Level
Social Issues (SI) – Page 41			
SI1	Yes	Group 2	
SI2	Yes	Group 2	
SI3	Yes	Group 2	
SI4	Yes	Group 2	
SI5	Yes	Group 2	
SI6	Yes	Group 2	
SI7	Yes	Group 2	
SI8	No	Group 2	Best at Project or Watershed Level
SI9	Yes	Group 2	
SI10	Yes	Group 2	
Civil Rights and Environmental Justice (CR) – Page 43			
CR1	Yes	Wilcox	

Appendix D: Maps

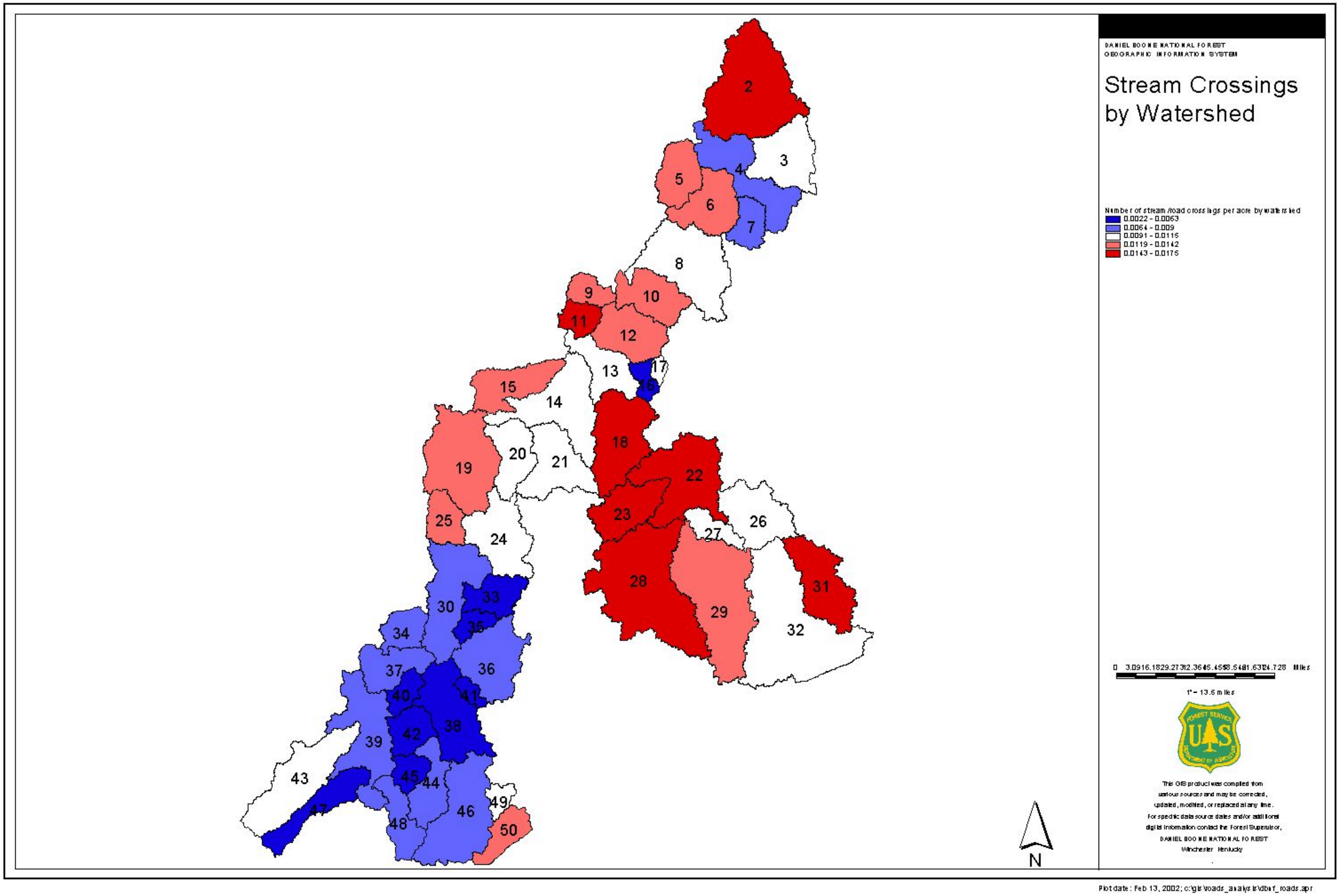

Figure 9: Map of Stream Crossings by Watershed.

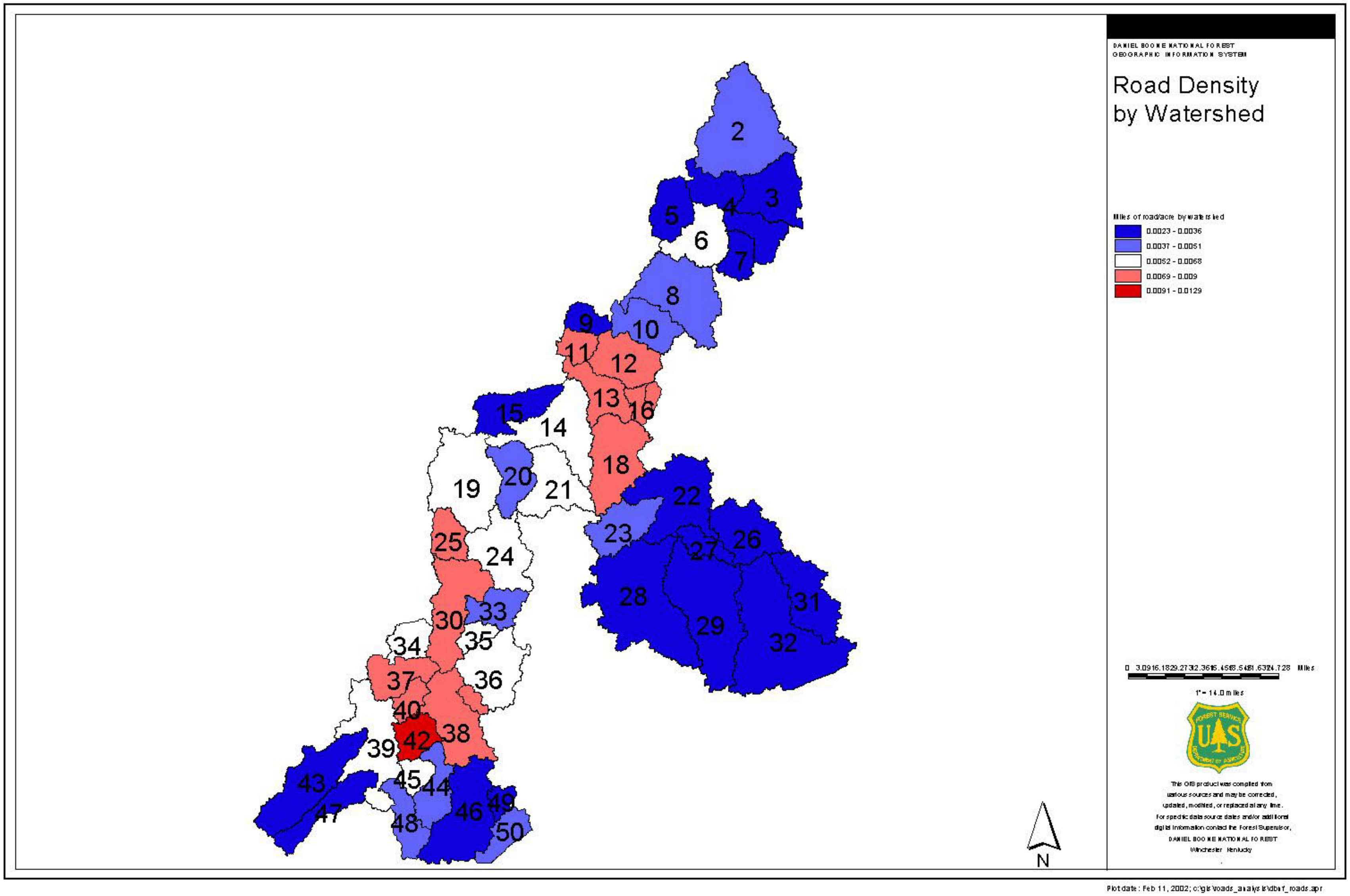

Figure 10: Map of Road Density by Watershed.

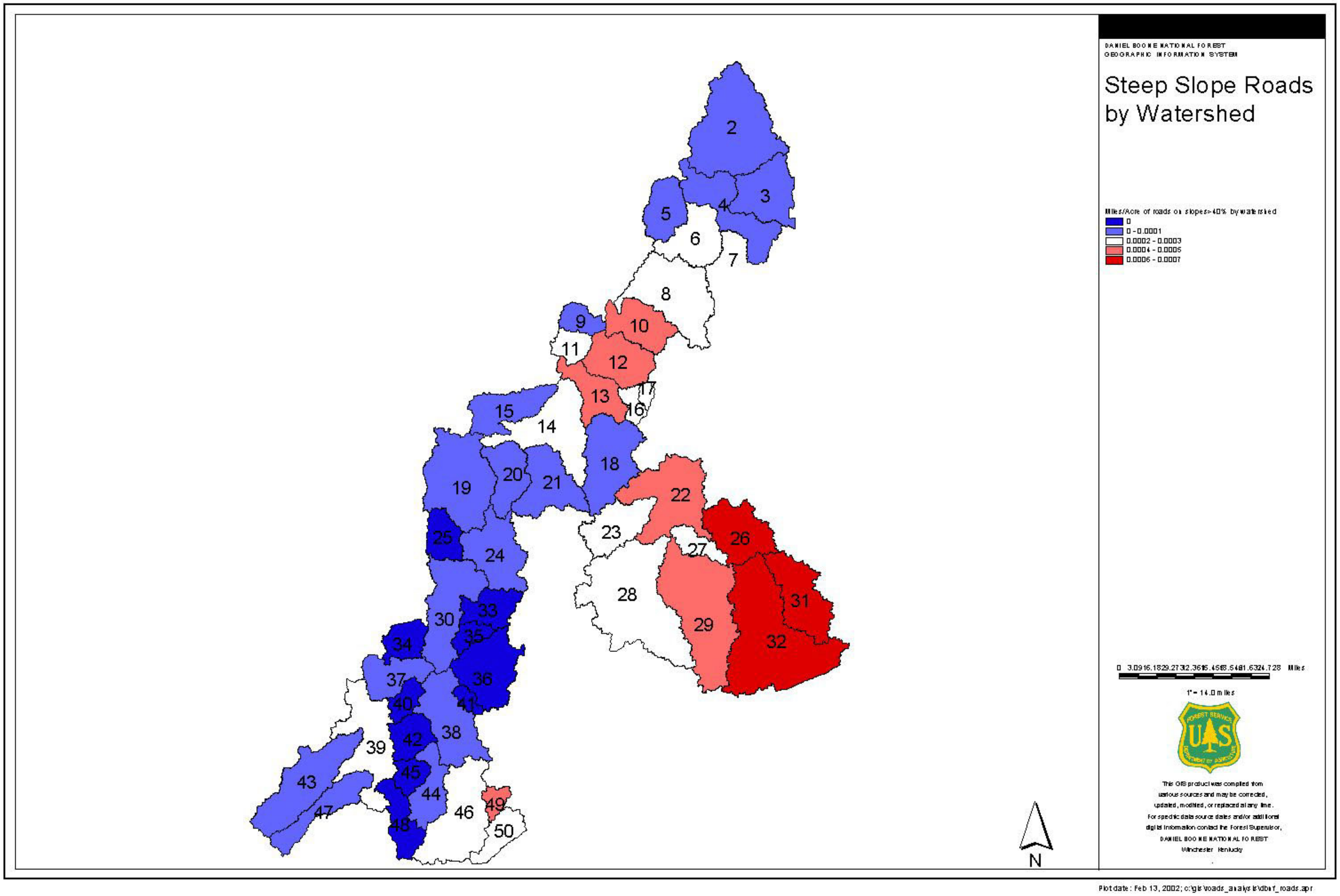

Figure 11: Map of Steep Slope Roads by Watershed.

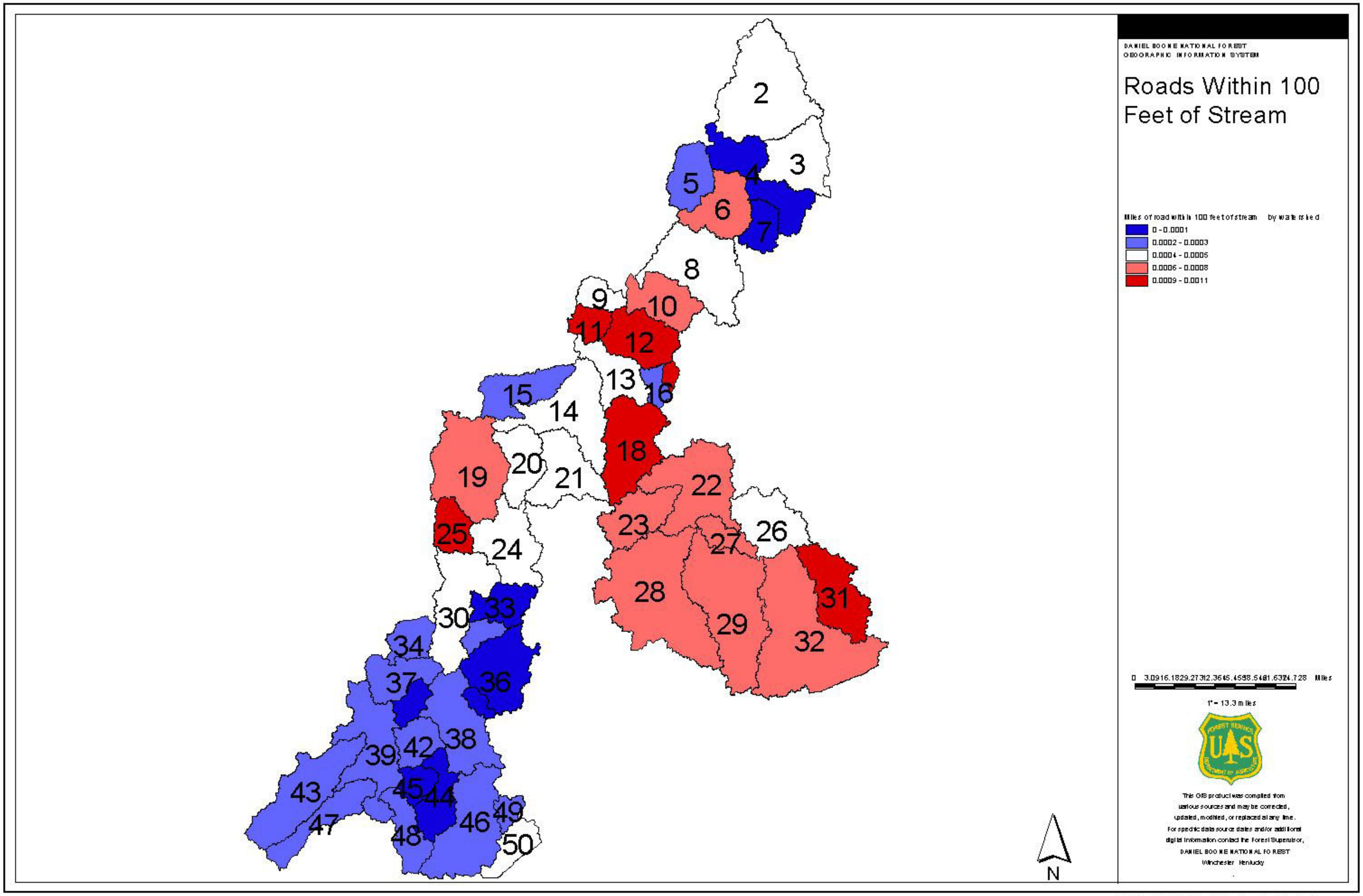

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Figure 12: Map of Roads Within 100 Feet of a Stream.

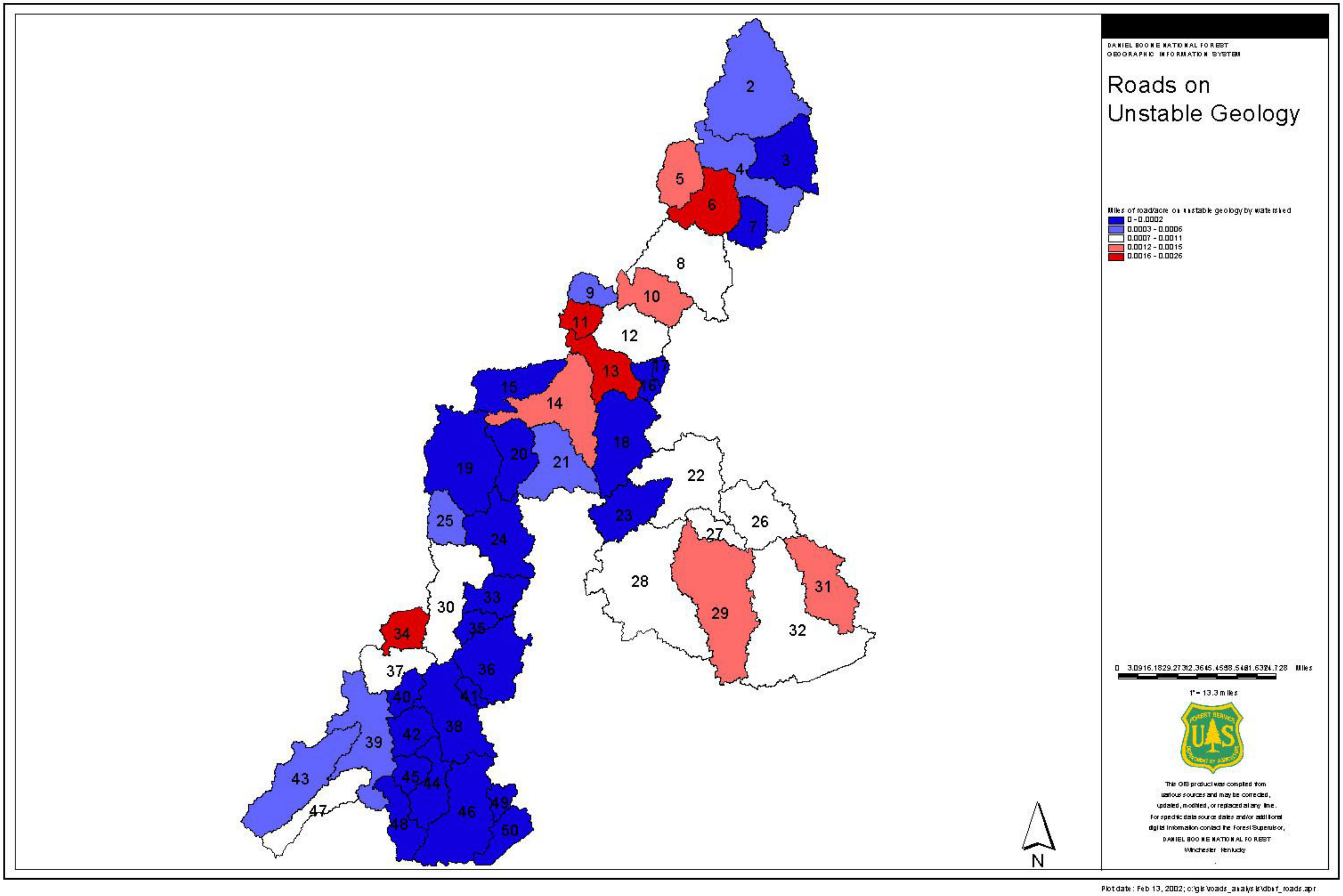

Figure 13: Map of Roads in Unstable Geology.

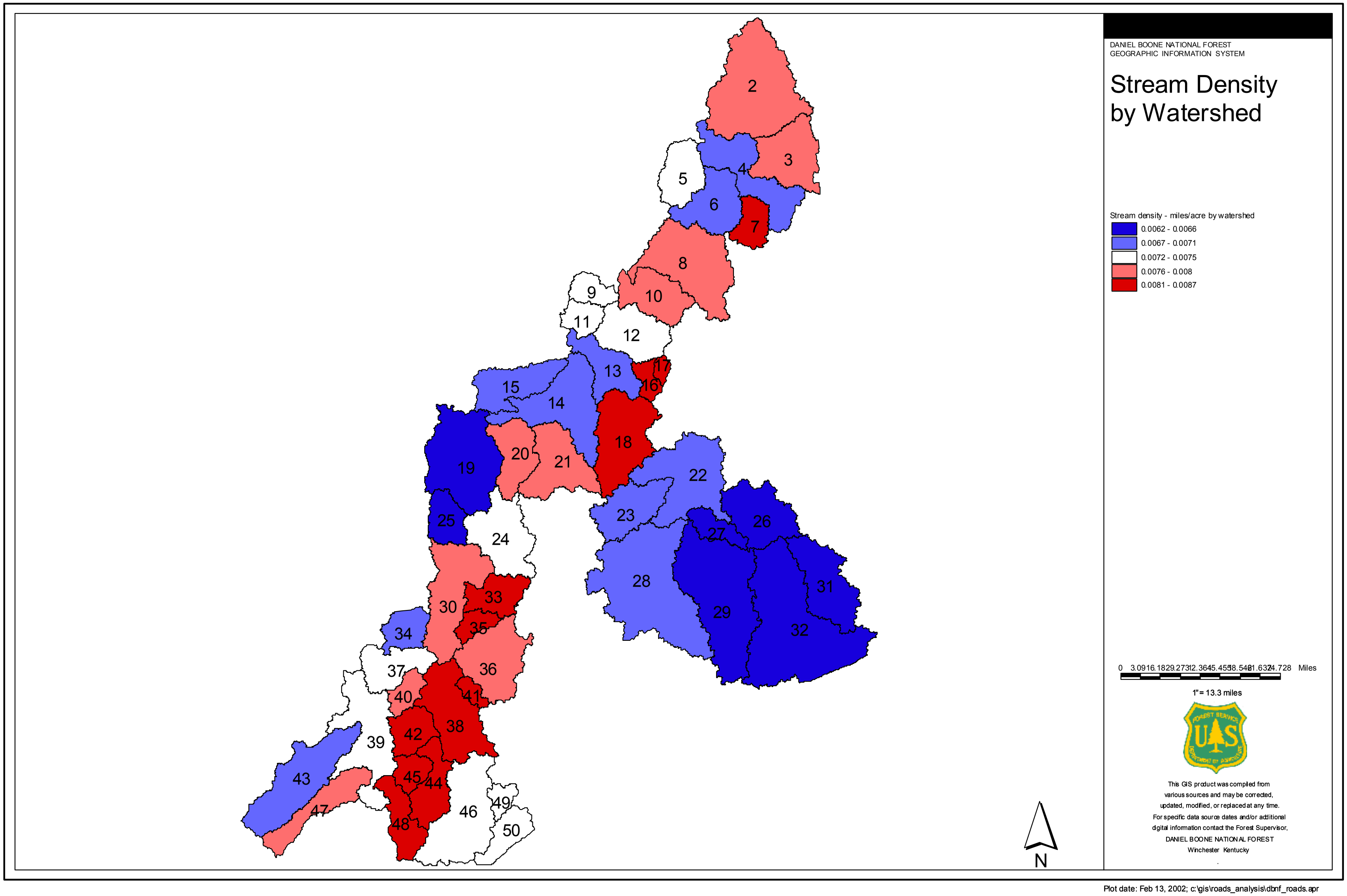

Figure 14: Map of Stream Density By Watershed.

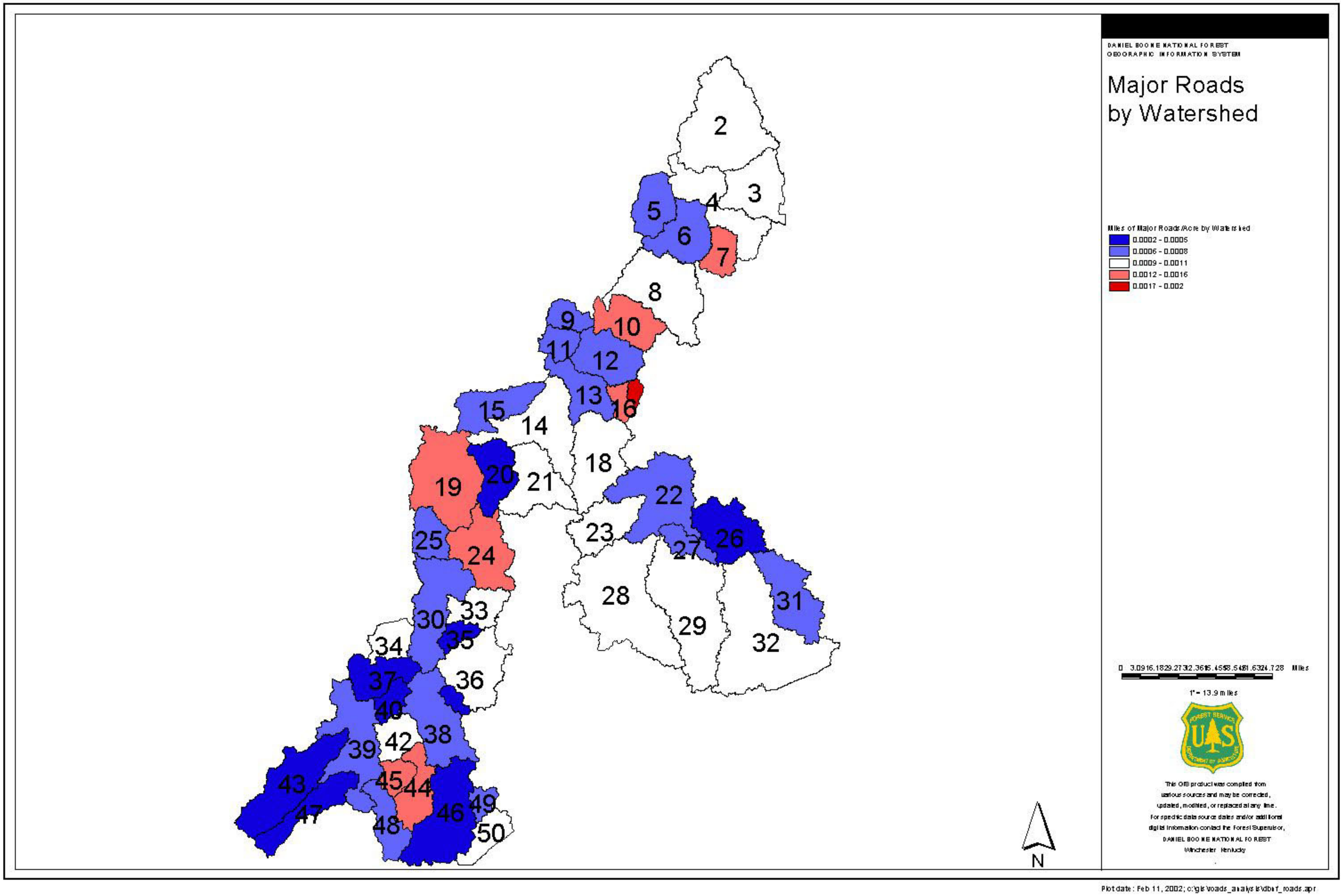

Figure 15: Map of Major Roads By Watershed